THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[Registered as a Newspaper.]

Vol. XXXI. No. 781.] LONDON, APRIL 30, 1878. [30th Year.] Price 6d.

COMPLETION of the FIRST VOLUME
OF
KING'S TREATISE
ON THE
SCIENCE AND PRACTICE
OF THE
MANUFACTURE
AND DISTRIBUTION
OF
COAL GAS.

[*For detailed announcement, see page* 688.]

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These Paints are now used in over 200 Country Gas-Works, and by all the London Gas Companies, on Gas-holders, Scrubbers, Purifiers, &c. Also used by the Admiralty, War Office, Railway Companies, Founders, &c. They prevent and arrest rust, and protect iron from the action of water, sulphurous and gaseous exhalations; do not crack, blister, or flake off; will cover tar effectually.
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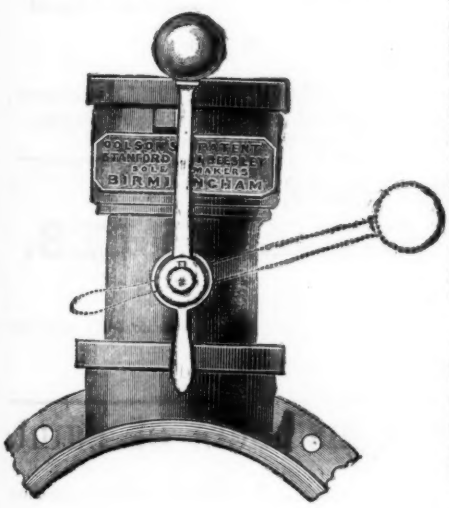
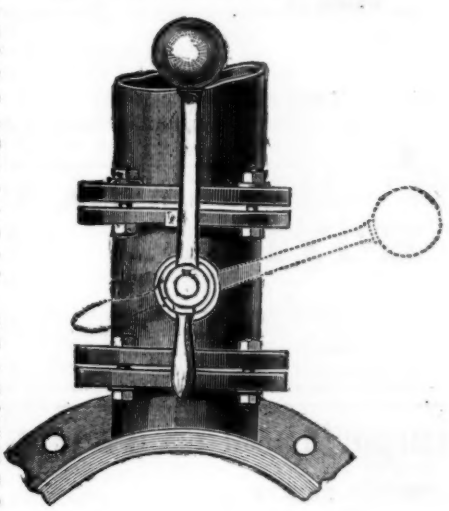
Or to the PATENTEE, 589, OLD KENT ROAD, LONDON, S.E.

COLSON'S PATENT ASCENSION-PIPE THROTTLE-VALVE.



THIS Valve is designed to supersede the hydraulic seal, and is intended to be placed immediately in or on the retort mouthpiece, or at such a distance therefrom as to be within reach of the workman. By the use of these Valves, the whole of the pressure is removed from the retorts, and a largely increased make of gas per ton obtained; the deposit of carbon is very slight, choked ascension-pipes are unknown, and the quality of the coke is improved.

When the retort is being drawn or charged, the lever, which is attached to a Spindle and Throttle-Valve, is thrown over as shown by the dotted lines, thereby closing the ascension-pipe; but when the retort is sealed, the lever is placed in a vertical position, and a free way made for the gas to pass to the relieving main.



Upwards of one hundred of these Valves have been continuously at work during the past six months at the Windsor Street Works of the Corporation of Birmingham, and no difficulty has been experienced in working retorts fitted with them in combination with others worked in the usual way with the hydraulic seal.

The following important testimonial has been received:—

Corporation of Birmingham Gas Department, Windsor Street Works, Feb. 17, 1878.

MESSRS. STANFORD AND BEESLEY.

DEAR SIRS,—In reply to your inquiry, I beg to say that the Valves (Colson's Patent) supplied by you in July last have given entire satisfaction. The retorts fitted with them are worked side by side with others having the ordinary dip-pipe, without any difficulty being experienced.

Yours truly, (Signed) CHARLES HUNT.

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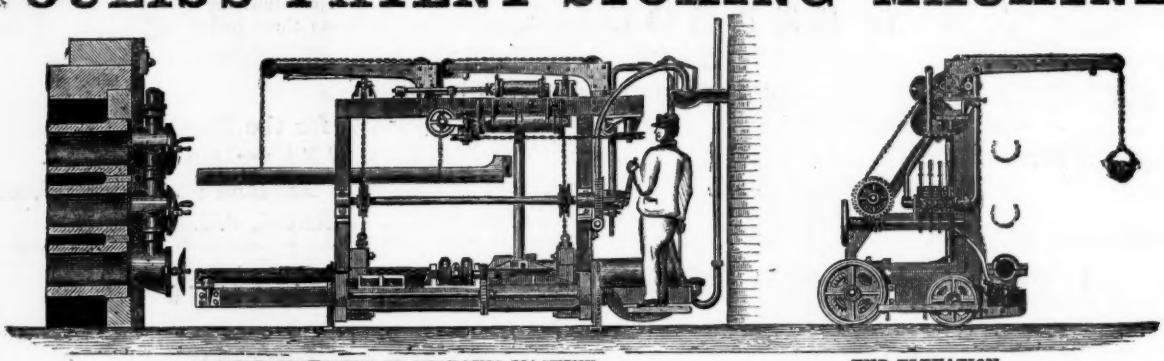

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(*The Drawing Machine will be Illustrated in next week's Advertisement.*)

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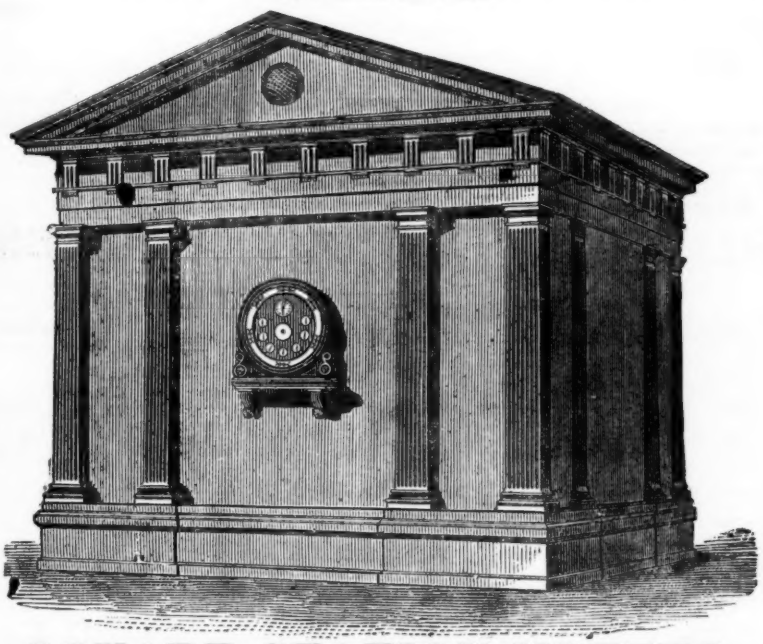

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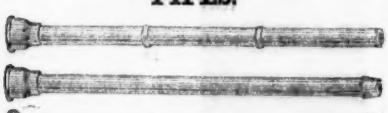

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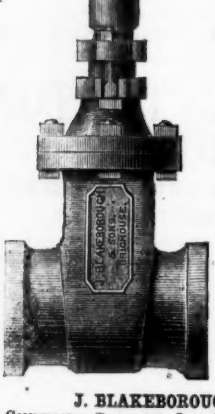

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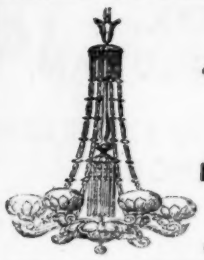

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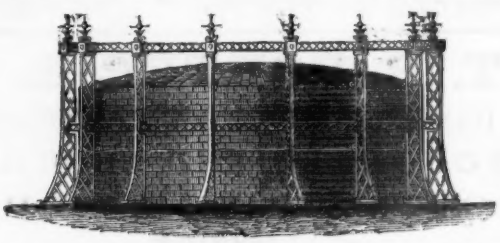

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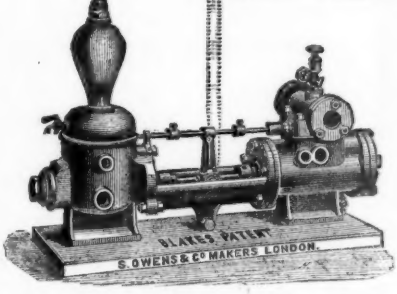
MANUFACTURERS OF
GASHOLDERS, WROUGHT AND CAST IRON TANKS, CONDENSERS, PURIFIERS, SCRUBBERS, MAINS, RETORT-LIDS, PLAIN AND DISHED, LAMP-POSTS, PIPES,
AND ALL REQUISITES FOR EITHER
GAS OR WATER WORKS;
ALSO
MAKERS OF ROOFS, BRIDGES, &c.

S. OWENS & CO.,
WHITEFRIARS STREET, LONDON, E.C.,
HYDRAULIC ENGINEERS,
AND MANUFACTURERS OF
PUMPING MACHINERY of every Description.
SOLE LICENSEES AND MANUFACTURERS FOR GREAT BRITAIN OF
BLAKE'S PATENT STEAM-PUMPS,
More than 10,000 in use,
ESPECIALLY ADAPTED FOR USE IN GAS AND CHEMICAL WORKS, FOR PUMPING TAR, WATER, AMMONIACAL LIQUOR, ACIDS, &c.
The following are some of the prominent advantages of the BLAKE PUMP:—

It will start at any point of stroke.
It has no dead point.
It works fast or slow, with the same certainty of action.
It is economical. Has a lead on the slide-valve.
It is compact and durable.



It is interchangeable in all its working parts.
It will deliver more water than any other pump.
It is made of best materials in the most workmanlike manner.
Can be worked at 20 strokes per hour, or 200 strokes per minute.

This Illustration represents Boiler-Feed Pumps, Sizes Nos. 1, 2, and 3, with Hand Lever for working Pump when Steam is not available.

SOLE MANUFACTURERS OF
MANN & OWENS
IMPROVED PATENT GAS-VALVES.

PRICED LISTS AND FULL PARTICULARS FURNISHED ON APPLICATION.

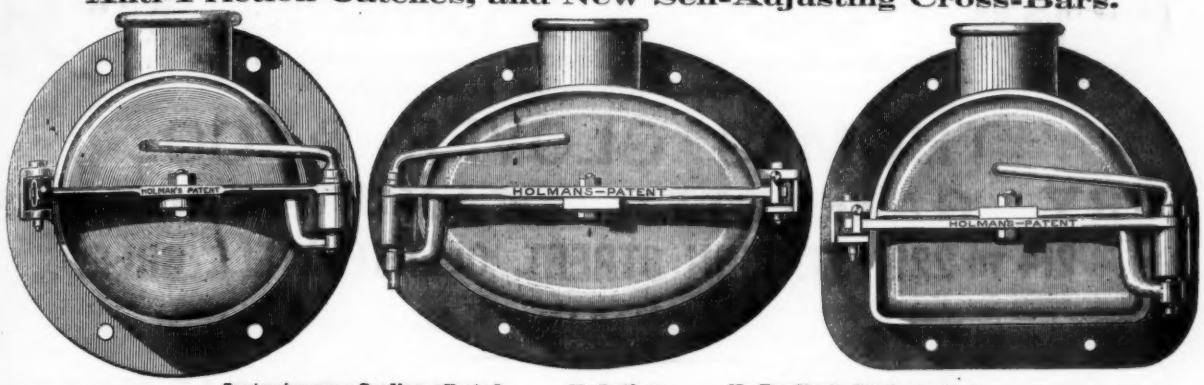
TANGYE BROTHERS AND HOLMAN,

CORNWALL HOUSE, 35, VICTORIA ST., LONDON, E.C.

(LATE OF 10, LAURENCE POUNTNEY LANE.)

SOLE MAKERS OF MORTON'S PATENT SELF-SEALING RETORT-LIDS.

WITH HOLMAN'S PATENT ECCENTRIC FASTENINGS,
Anti-Friction Catches, and New Self-Adjusting Cross-Bars.



Instantaneous Sealing effected. No Luting. No Duplicate Lids required.
Holman's New Self-Sustaining Cross-Bar ensures freedom of Joint, and maintains parallel position of the Lids.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested, being now in use in nearly all the principal Gas-Works in London and the Provinces.

T. B. and H. are now making the "Morton's Self-Sealing Lid" of the SAME FORM OR SECTION AS THE RETORT (see Illustrations above), as well as bringing the Mouthpiece from the D or Oval at back to Circular in front, as heretofore.

D and Oval Morton's Lids are working satisfactorily both in this country, on the Continent, and in the United States of America. Among others they have been adopted by the following Gas-Works:—

The Gaslight Company's Works, Fulham; Ditto, Bromley-by-Bow; Ditto, King's Cross; Ditto, Shoreditch.
And also in the Gas-Works at Richmond, Maidstone, Gloucester, Glasgow, Portsea, Roubaix (France), The Hague (Holland

HUNT'S PATENT EQUILIBRIUM GAS-GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at an convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.

These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight and Coke Co. (9), The London Gas Co. (3), and at Abergavenny, Arundel, Birmingham, Cannes (France), Devonport, Dursley, Exeter, Guernsey, Halesowen, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, Windsor, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875.

MESSRS. TANGYE BROTHERS AND HOLMAN.

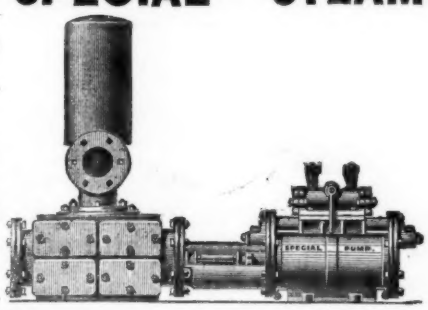
Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

Yours truly,
(Signed) JOHN JOHNSON.

PRICES AND FULL PARTICULARS ON APPLICATION.

THE "SPECIAL" STEAM-PUMP.

Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Gallons of Water per Hour, Approximate.	Reduced Prices.
3	1½	9	450	£16
4	2	9	815	18
5*	2½	12	1,250*	20
5*	3	12	1,830*	22 10
4	4	12	3,250	25
6*	4	12	3,250*	30
5	5	12	5,070	32 10
7*	5	12	5,070*	40
6	6	12	7,330	40
8*	6	12	7,330*	50
7	7	12	9,750	50
10*	7	12	9,750*	65



In use in a Hundred Gas-Works in the United Kingdom for Pumping Ammoniacal Liquor, Water, or Tar.

Messrs. Burt, Boulton, and Haywood, Manufacturing Chemists, have over FORTY "Special" Steam-Pumps in use at their several large Tar-Works.

Two Hundred Sizes made. Those in Table opposite are the leading Sizes for use in Gas-Works and Chemical Works.

* These Sizes being usually selected for pumping Tar and Liquor, are always in stock, or nearly ready, fitted with all pump details in iron, and extra length distance-piece between steam and pump cylinder, at a small extra cost.

TANGYE'S HIGH-PRESSURE AND CONDENSING STEAM-ENGINES; CORNISH, VERTICAL, & TUBULAR BOILERS; HYDRAULIC AND SCREW LIFTING-JACKS, CRABS, PULLEY-BLOCKS, &c.

FULL PARTICULARS, ESTIMATES, CATALOGUES, ETC., ON APPLICATION.

London, 1851. New York. 1853. Paris, 1855. London. 1862.

Dublin, 1865. Paris, 1867.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS,

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON & CO.

(ESTABLISHED 1816)

ARE THE ONLY MAKERS

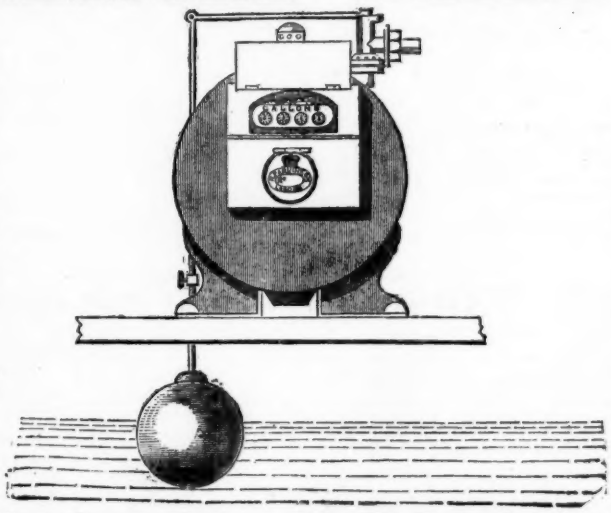
OF THE

LOW-PRESSURE WATER-METER.

These Meters will register with perfect accuracy, either at full speed, or with a few drops only passing through them.

They must be placed over the cistern to be supplied, and the water, after being measured, will fall from the outlet into the cistern below. Each Meter is fitted with a ball-valve, so made that it can be adjusted to shut off the supply at the inlet when the water reaches any required height in the cistern.

The 100-gallon Meter is fitted with a cistern holding about three or four gallons, and may be fixed inside a house, free from the effects of frost, and requires no attention after once being fixed.



From "The Engineer," April 6, 1877.

"Low-pressure Meters have been found to register with almost perfect accuracy, or, at all events, within 5 per cent. either for or against the consumer, and from the nature of their construction are by no means easily deranged. Still, even the low-pressure meters have their disadvantages, but these are chiefly as respects the question of first cost, seeing that they must have a cistern fixed at a higher level than that at which the supply is needed. All things considered, however, the balance of opinion rules at present in favour of the low-pressure Meter, and they are consequently increasing in favour as time goes on."

These Meters have been manufactured by W. P. & Co for more than 25 years and are largely used by the following and other Water Companies:—

NOTTINGHAM, DERBY, LEICESTER, SUNDERLAND, GREAT YARMOUTH, SHEFFIELD, NORWICH, LOWESTOFT, COVENTRY, SOUTHEND.

COTTAGE LANE, CITY ROAD, LONDON, E.C.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

UTILE.—*We have not space for your communication.*

Several communications have reached us too late for insertion in the present number.

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, APRIL 30, 1878.

Circular to Gas Companies.

It may be that, after all, a complete Municipality for the Metropolis will be sooner arranged than many people suppose. We are credibly informed that at this moment the Corporation of the City of London have under their consideration a scheme which proposes to constitute the several metropolitan parliamentary boroughs into wards, which will dovetail into the City arrangement. At present, of course, no details are made known; nor is the authorship of the scheme announced, but it may be reasonably guessed that the distinguished Chamberlain of the Corporation, Mr. B. Scott, who is so profoundly acquainted with metropolitan local affairs, has something to do with the plan now propounded. It is not a novelty, for we are informed that it has been under consideration for the last eighteen months. It will probably be under consideration for many more months, and, perhaps, for several years; for so complicated a business is not likely to be settled within a short period. An immense amount of opposition is to be expected from the Vestries and District Boards, or, rather, from the small-minded Members of these bodies, who will fear to lose local influence, and their share in the profits of local jobbery. Thus we anticipate that great obstacles will be raised, even to the most carefully considered scheme for improving the local self-government of the Metropolis. At the best, it will take years before anything can be accomplished, and then, as hinted before, only with the support of a strong Government. It is well, however, that reforms should begin from within; they are then usually conservative, and not destructive; and for this reason we are glad to learn that the question of municipal extension has been taken in hand by the Corporation of the City of London.

It will be asked what this has to do with the Metropolitan Gas Companies. It may be nothing, it may be much. We remarked last week, that the fate of the Metropolitan Gas Companies is in their own hands. They have the chance of demonstrating that they can do better for their Customers than any Municipal Authority, however constituted; but for this purpose they must be united. All that is to be gained by concentration of management under a Local Authority can be obtained by the complete amalgamation of the Companies, and this effected, we do not anticipate that any Municipality would attempt to disturb the amicable relations of the Company and the Consumer. The time, as we have said, is ripe for combination. A year or two will bring fresh Companies under modern legislation, and the opportunity will then, if not before, arise for considering how far additional unions may be advisable.

We are happy to learn that the new gas-works at Tunbridge Wells are in progress of construction. A very interesting meeting was held the other day, when a foundation or memorial stone was laid by Mr. Hunter, the Chairman of the existing Gas Company. We do not feel quite certain that the report before us gives us the full history of gas enterprise in Tunbridge Wells, for that town was one of the fashionable inland watering-places so much frequented towards the commencement of the present century, before seaside resorts became popular. But it would appear that the use of gas was introduced so recently as 1835, and then only by a private individual. In 1843 this very limited undertaking passed into the hands of the present Company, who did their best, and with success, to enlarge the undertaking. The difficulties in recent times which they have had to encounter, in consequence of the opposition of the Local Authority, have been recorded in these columns, but now, with a well-selected site and excellently designed works, parts of which have already figured in our "Treatise," Tunbridge Wells promises to be one of the best lighted towns in the kingdom.

The Town Clerk of Wigan, as will be seen in another column, is not satisfied with the decision of the Borough Magistrates, who inflicted a small fine on the Corporation for not depositing their gas accounts. We think a more careful study of the general Acts of 1847 and 1871, together with the Wigan Improvement Act, will satisfy him that the Magistrates were right. The former make no distinction between Companies and Corporations. The word "undertakers" evidently includes both. In 1847, we dare say, Corporations were not thought of, for very few possessed gas undertakings; but in 1871 purchases had become more common, and we imagine the Legislature fully considered their cases. The Wigan Improvement Act, like all special Corporation Gas Acts, certainly exempts the Corporation from the obligation of some of the clauses of the general enactments; but we do not make out that there is any exemption from the obligation to file accounts. In fact, clause 35 of the Act of 1871, which requires "the undertakers to fill up and forward to the "Local Authority of every district within the limits of the "Special Act, on or before the 25th day of March in "each year, an annual statement of accounts made up to "the 31st day of December then next preceding," is not one of the clauses which is excepted by clause 79 of the Improvement Act of 1874. It may, indeed, be supposed Parliament considered it advisable that Local Authorities should be required to deposit their accounts in a particular form, in order that the ratepayers might have full information as to the profits of their undertaking. If the Town Clerk admits that it may be useful to publish the accounts for the information of the Gas Committee, we deem it equally advisable that they should be printed for the satisfaction of the inhabitants.

It might be thought that at the present time the subsoil of our roadways and pavements was sufficiently occupied with gas-pipes, water-pipes, and telegraph wires; but it seems to be seriously proposed in Liverpool to add a fourth occupant. A great central station is suggested, where a number of dynamo-electric machines, driven, of course, by steam power, are to be placed, from which wires conveying the electric current should radiate to all parts of the City, where the electric light can be utilized. The idea looks very well on paper; but we fear that difficulties might arise in carrying the plan into execution. Foremost, we may take it, would come the expense, which the projectors evidently foresee; but this is met by the suggestion that water might be substituted for steam power, to supply which the tides might be laid under contribution. The project is, however, in a very crude state, and we do not think the Liverpool United Gas Company have any reason to fear the competition of the electric light. The Town Council, who are evidently desirous of experimenting with the light, may, however, make a note of it, perhaps, and decide on leaving the Company in undisturbed possession of their property.

We are sorry to see the excellently managed Plymouth Gas Company have been accused of supplying bad gas. It is, of course, the old story of bad burners, resulting in imperfect combustion. A consumer gets his ceilings blackened, and immediately

complains that the Company are supplying "dirty" gas. It is seldom possible to convince a man who is totally ignorant of the matter that the soot deposited on the ceiling is so much carbon wasted, which, if the gas had been properly consumed, would have added to the brilliancy of the light. One good thing we expect to result from the now frequent exhibition of gas apparatus, and that is the diffusion of useful knowledge on the subject of burners. We hope that at the forthcoming Birmingham Exhibition care will be taken to display a collection of good and bad burners, including some old and corroded metal burners still so commonly used, to show the necessity for the frequent examination of these instruments.

The Corporation of Ipswich have selected a very improper situation for a gas-testing station, and the Gas Company very properly object. Some in the Corporation argue that gas should be tested where it is worst; but there is no question of good gas in one part of the town and bad in another. To be fairly and properly tested, the gas should be taken from a main where there is a free circulation, and this the Ipswich Company insist upon, as would the Corporation if they possessed the undertaking. It would be most improper and unfair to test "dead" gas, which most likely has lost a portion of its illuminating constituents.

An old idea, it seems, has been revived, and it is again proposed to distribute water gas for heating purposes. There can be no doubt that, if a really practicable method for its production on a large scale could be devised, some economy might result from its use; but it would be at great risks. Everybody knows that carbonic oxide, which constitutes a large portion of the gas, is a deadly poison. It is, moreover, odourless, and, consequently, an escape would not be noticed. There is, therefore, the double risk of asphyxia from its presence, and of explosion in consequence of the mixture of hydrogen.

We are promised a new solution of the "sulphur" difficulty. Mr. F. J. Evans and Mr. W. T. Sugg have jointly taken out a patent for the "Manufacture of coal gas," &c., which includes a method of removing the impurities in crude gas. We shall publish a full description of the plan when the drawings necessary for the illustration of the mechanical details are prepared. In the meantime, we may give a brief outline of the system from a chemical point of view. The gas generated as usual in the retorts passes up the ascension-pipes, which have either been jacketed or coated with some non-conducting material, so that the gas is delivered into the hydraulic main at the temperature of about 200° Fahr. Simultaneously there is passed into the hydraulic main a stream of ammonia, either in a vapour form or solution, where it is brought into immediate contact with what we may call the nascent gas at a rather high temperature. This is considered favourable for the union of the sulphur compounds and carbonic acid with the ammonia. We confess to having some doubts as to whether or not carbonic acid will combine with ammonia at 200°; but, as regards the sulphur compounds, it may be that such a temperature rather favours the combination. This is a point, however, which can only be settled by experiments. From the hydraulic the gas passes on to a special apparatus, which will be duly described and figured. Here the tar is deposited, and then the gas goes on to the scrubbers, and whatever system of purifiers may be considered necessary. This is a very brief account of the plan, which is now, we believe, on trial at the Silvertown works, with what result has not yet been made known. We sincerely hope that it may prove a success, for it is calculated to relieve managers of many difficulties.

The above-mentioned plan has the merit of simplicity and cheapness, which we cannot say for another invention to accomplish the same object, which is made public almost at the same time. It is a process devised by "Julius Von Quaglio, Chief Engineer at the Gas-Works of Stockholm." This gentleman proposes to cause the gas, on its way, we presume, to the oxide or lime purifiers, to traverse pipes heated to redness, and stuffed with rolls of platinum foil, or, indeed, with thin *laminæ* of any one of the platinum series of metals, including the most expensive. It is only fair to say that the first outlay will be the chief cost, for the action of the purifying metal would, like Tennyson's brook, "go on for ever." The same, however, must be said for the Rev. W. B. Bowditch's lime. The reactions are simple, bisulphide of carbon is decomposed, and sulphuretted hydrogen is formed, to be removed at a subsequent stage. M. Quaglio's system is not likely, we fear, to be extensively adopted.

An enterprising American editor has taken the pains to compile statistics on "American Gas Making,"* an imitation, we suspect, of the valuable annual report published by our friends, the West of Scotland Association of Gas Managers. The book we notice possesses much interest, but it mainly concerns Americans and Canadians. We have on previous occasions given a list of the prices charged for gas in the principal cities in the States, which must have staggered the consumers of this country. We learn from this compilation that the charge for gas to private consumers in the States and Canadas varies from 0·90 of a dollar per thousand cubic feet at Harrisburg, Pennsylvania, to 10 dollars —that is over £2 per thousand cubic feet—at Woodstock, Vermont. We wonder what London Vestrymen would say to paying 30·16 dollars a year each for public lamps, consuming three feet an hour, as they do at Brooklyn, New York, the illuminating power being fifteen candles. The quality of coals in America is necessarily very various. The editor has committed one fault—he gives us the amount of coal carbonized annually in the several cities and towns, and also the bulk of gas produced in the course of the year. It will be well if, in the publication of another issue, he will give, as now, the coal carbonized, and state the average quantity of gas produced per ton. In the present form he causes his readers to make a great many calculations.

The sixth Annual Meeting of the West of Scotland Association of Gas Managers was held at Paisley on Thursday last, under the presidency of Mr. James M'Gilchrist, and we shall, in due course, furnish a report of the proceedings on that occasion. We are gratified to learn that the meeting was, both with reference to the attendance of members and the interest maintained throughout the sittings, a complete success.

The second General Meeting of the North of England Gas Managers Association was held at Newcastle-on-Tyne on Saturday last. The address of the President (Mr. Warner), and a report of the proceedings, will find a place in our columns as early as possible.

The current monthly number of the "Treatise on the "Science and Practice of the Manufacture and Distribution of "Coal Gas" completes the first volume of the work. We are fain to admit that the book has grown to dimensions which we did not originally contemplate, but materials have come so fast to our hands which we have deemed it of importance to insert, that a great extension of our original design became unavoidable, in order that the information contained in the work might be brought down to the most recent date. To mention the numerous friends from whom we have received assistance would occupy a large space, and we must leave a special recognition of their kind services until the work is finally completed. An advertisement by the Publisher, in another column, will inform our readers of the arrangements made for the issue of the bound copies of the first volume.

Water and Sanitary Notes.

A RATING case, possessing some interest to Corporations having water undertakings, was recently heard before the Earl of Chichester and a full Bench, at Lewes. The Corporation of Brighton include within their water limits the parish of Preston, which is rated for poor law purposes to the Steyning Union. There was no question about the rateable value of the Corporation plant within the parish; but, as our readers will remember, the Corporation of Brighton make a considerable profit upon their undertaking, and recently the Water Committee transferred £2000 of these profits to the credit of the borough fund. It was to include a portion of this sum in the assessable value that the Guardians of the Steyning Union took proceedings. There was another point raised; but the interest centres in the claim to include the £2000 as adding to the value of the undertaking. In this contention the Guardians were successful. It follows that, if this case be not carried to a higher Court, profits of gas and water undertakings transferred to the borough fund are an element of rateable value. The hypothetical tenant would, of course, take account of the £2000 when agreeing for a lease of the undertaking.

The Metropolitan Board of Works are about to introduce a new Thames Floods Prevention Bill. They still cling to the notions which prevailed in the Board last year, and decline to make the cost of the necessary works for the prevention of these floods a charge upon the whole Metropolis. They still desire to make the owners of property, and the riparian Vestries and District Boards, chargeable for the cost of the works, which, when constructed, are to be under the supervision of the Metropolitan Board. They also agree to be responsible for damages which may be caused by an overflow in future; but they propose to distribute the cost of such damage among the riparian Authorities. We doubt whether this is a measure that will satisfy the Home Secretary, and we fully expect, therefore, that it will meet with

* "American Gas Making; a Compendium of Useful Information relative to Price Charged for Gas, Quantity Annually Made, Amount and Variety of Coal Used, Price for Public Lighting, &c., together with the Population of the Principal Cities and Towns." By Frederick E. Saward. New York. 1878.

the opposition of the Government. It would be far better if the Metropolitan Board would fall in at once with the suggestions of an Authority superior to themselves, and loyally carry out the work they have been, in a measure, directed to do.

We have as yet no knowledge of the way in which the award sent "greeting" by Mr. W. H. Higgins, the Umpire, to the joint Boards of Stockton and Middlesborough has been received. It must have carried great consternation to the Committee; but still they have a chance of making some good of the undertaking. It must for a few years be a heavy burden; but with more prosperous times and a great revival of trade, the works may be expected to prove remunerative with no very heavy rates.

Lambeth is protesting against the increased rates levied by the Southwark and Vauxhall Company. There can be no doubt that, for some years past, the district has been under-assessed, and now that the Company are in what we may call low water, it is not unreasonable that they should endeavour to increase their revenue by all legal means. They are fully justified in the step they have taken. Of course, it is disagreeable to have to pay increased charges; but such *désagréments* happen to people every day, and they are borne with composure, if not with satisfaction.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

HOW NOT TO DO IT.

SIR,—Under this heading, in your JOURNAL of April 23, "A Country Gas Manager" asks, Can a Consumer compel a Gas Company to supply him with gas? I reply that the Gas-Works Clauses Act, 1871, clause 11, gives a Consumer that power, provided he is within 25 yards of the Gas Company's mains.

It is stated that a certain cottage requiring a supply of gas is beyond 30 *feet* of the Company's main, and is, therefore, 15 *yards* within the distance named in the Act. In such a case he can demand a supply of gas, but would be liable to pay the cost of the extra 15 *feet* of main, and for any length of service-pipe across his private ground to the cottage. The Company can, moreover, demand a guarantee that the Gas Consumer shall take, and pay for, a supply of gas for at least two years, and that the rent payable on the same shall be not less than 20 per cent. on the outlay incurred by the Company, and the Company can secure this payment by requiring a deposit for the gas to be supplied. If a Tenant is willing to make these payments, a Magistrate's summons would settle the matter; but surely, if the Manager of the gas-works shows his Directors, in clear figures, that the consumption will warrant the outlay, no such pressure would be necessary; and as I think it unlikely they would allow such a case to come into Court, the "Country Gas Manager" may, therefore, ask in vain for any *legal* decisions on the point.

MAGNUS OHREN.

Lower Sydenham, April 26, 1878.

SIR,—There was a letter in your last JOURNAL, from a "Country Gas Manager," respecting clause 11 of the Gas-Works Clauses Amendment Act, 1871, to which, if you can find the space in your next, I should like to make some observations in reply.

I will endeavour to be as brief as possible, for my own sake as well as yours; but to answer the matter fully, must, I fear, encroach somewhat largely upon your indulgence.

Reciting, then, only so much of the clause as is necessary for this purpose, it is as follows:—

"*Supply of Gas to Owners and Occupiers of Premises.*

"The undertakers shall, upon being required so to do by the owner or occupier of any premises situate within 25 yards from any main of the undertakers, or such other distance as may be prescribed, give and continue to give a supply of gas for such premises, under such pressure in the main as may be prescribed, and they shall furnish and lay any pipe that may be necessary for such purpose, subject to the conditions following (that is to say):—The cost of so much of any pipe for the supply of gas to any owner or occupier as may be laid upon the property of such owner or in the possession of such occupier, and of so much of any such pipe as may be laid for a greater distance than 30 feet from any pipe of the undertakers, although not on such property, shall be defrayed by such owner or occupier. Every owner or occupier of premises requiring a supply of gas shall, with other things, enter into a written contract with the undertakers (if required by them so to do) to continue to receive and pay for a supply of gas, for a period of at least two years, of such an amount that the rent payable for the same shall not be less than £20 per centum per annum on the outlay incurred by the undertakers in providing any pipe to be provided by them for the purpose of such supply."

The operation of this clause may be described thus:—If a house is within 25 *yards* (75 feet)—not 30 feet, as stated in the letter—of a Company's mains, or if the house has a garden, forecourt, or open space in front, and the outer wall of such garden or forecourt, or the outer boundary of such open space, is within the 75 feet, the occupier of the premises can call upon the Company to give a supply, and to furnish and lay a service into such house, or into such garden, forecourt, or open space, as the case may be, for that purpose, and the Company, by clause 36, are liable to a penalty of 40s. per day for every day they neglect or refuse to give such a supply.

The 30 feet has no bearing upon this point; it relates solely to the cost of furnishing and laying down the service for such supply, which is specially provided for as under. The first 30 feet to be furnished and laid at the expense of the Company, and all the rest at the expense of the occupier.

When the service is laid into the premises—that is, the house, or garden, and so forth, as the case may be—the Company's obligation ceases, the occupier may then either do the other part himself, or employ the Company to do it for him, but in either case at his own expense.

The provision about giving security for a rental, equal to 20 per cent. on the outlay incurred by the undertakers, for two years originated in the Metropolis Gas Act, 1860; but as, under that Act, the Companies were compelled to furnish and lay down 150 feet at their own cost—and the paving in London is much more costly than in the country—the provision in that case was of some value; but with the length reduced from 150 feet to 30 feet—an outlay of no more than 15s. or 20s. at the outside—it is not worth a moment's consideration one way or the other.

It has always been contended that all Companies under statutory regulations are by implication, and without express statutory provision, under an obligation to furnish a supply of gas to all persons requiring it in their district, without distinction or favour.

When the Act of 1871 was under consideration, a deputation from the Gas Companies had several interviews with the Board of Trade respecting it. It was then urged upon the Board that if the Companies were under this implied obligation, they might be called upon to extend their mains into places where there would be no possible chance of their ever becoming remunerative, and consequently there ought to be some limit to it. The clause was therefore altered so as to make a limit of 25 yards, and leave any further extension of the mains at the discretion of the Companies.

To prevent any misunderstanding upon this point, I will endeavour to explain it in another way, as thus: Suppose a main to be laid for some distance through a large thoroughfare, and to terminate at, say, the eastern end of it, the intention was that persons living 25 yards from that end should not be entitled to call upon the Company for a supply, and thus to compel them, as it were, to extend their mains; but it was not intended to relieve the Companies of any obligations they were under at that time, implied or otherwise, with respect to premises on the line of main.

The clause, however, as it now stands, would seem to justify a Company in refusing a supply to any premises, even on the line of main, that might happen to be more than 25 yards from it.

As the Companies are protected by the provision, that in no case shall they be under an obligation to supply more than 30 feet at their own expense, it seems an absurdity to provide that they shall not be required to give a supply when the service would be more than 75 feet, even if the consumer was willing to pay for the service. Such a provision could only be prejudicial to the public, without being any benefit to the Companies.

As an illustration of the effect of this, suppose a Company, for some purpose of their own, laid their main on one side of a street, so that the houses on that side were all within 10 feet, while those on the other were upwards of 75 feet, the Company in such a case would be under an obligation to supply houses on one side, but at liberty to refuse a supply to the houses on the other side; or, suppose the case of two persons carrying on the same business in competition with each other, and living in the same street, with the main passing in front of both houses, but more than 25 yards from them, a Company might give a supply to one, and refuse a supply to the other. It is impossible to suppose that the Legislature, in granting powers to a Company to supply a certain district with gas, and thereby excluding all other Companies and persons from doing so, ever intended that a Company should have such powers as these; and yet, if we assume that the giving a supply beyond the 25 yards is entirely optional, and free from any implied obligation, it leads to all this and much more that would be equally unjust. If a case of this sort were brought before the Courts, all these considerations would have weight, and it is not improbable that, notwithstanding the 11th clause, the decision would be against the Company.

But, apart from all this what reason can there be for refusing a supply in such cases? Will any person who says they do not pay, undertake to show how he arrives at such a conclusion? The cost, as stated before, would be 15s. or 20s. for each house at the outside, and this, if charged to capital, would require a profit of only 1s. 6d. or 2s. per annum on each house to pay 10 per cent.

Will any gasman pretend that for every additional 10,000 feet of gas brought into his ledger he has to carbonize an additional ton of coals, or pay more wages, or put up more retorts, or enlarge his gasholders?

On the contrary, the half-yearly accounts show again and again that, while the consumption of coal has decreased, and the wages the same, more gas has been sold, and more rental received.

The truth is, that the plant, in almost all cases, is, as it ought to be, greatly in excess of the immediate requirements of the Company, and, so long as the supply is within the compass of the plant, extensions can be made to a very considerable amount, without any increase of cost whatever; and, rightly considered, extensions are almost wholly so much additional profit.

The greater the quantity of gas made with the same plant, the less the cost of the whole quantity made, and the less the quantity lost or unaccounted for. All Companies, therefore, great and small, ought to make every effort they possibly can to extend the supply, and not try, as the small Companies too frequently do, to restrict it.

W. LIVESEY.

Gas and Water Companies Association, 5, Victoria Street, Westminster, April 29, 1878.

THE USE OF SEA WATER IN GASHOLDER-TANKS.

SIR,—At present there is being put in for this Company a cast-iron tank, 81 feet diameter, 20 feet deep, with a gasholder 80 feet by 20 feet to work in the same. The excavation for the tank is nearly finished, and I send you a section of the soils we have passed through—viz., 6 feet of pure sharp sea sand, without a stone in it larger than a bean. Under this a bed of from 6 to 18 inches of gravel, from which came the water we have, occasioning a slip of the bank now and again. Under the gravel was a bed of very fine clay from 2 to 3 feet thick.

Under this clay we had very hard red boulder clay, what navvies would term "plum pudding." This clay stood very perpendicular when excavated. It was anticipated that, during the excavation, water would be abundant, and provision was made, in the specification, for

forming a drain to the harbour, a distance of a few hundred yards, so that the water to be pumped might be carried away.

The Contractor, at some expense, brought up the said drain deeper than I intended, thinking that the nearer to the bottom of the excavation he could bring his drain, the less the water that he would require to pump.

It turned out, however, that the water came from the gravel bed, and hence a 3-inch tile drain-pipe was carried round a scarsement, on the top of the hard clay stratum which conducted the water, and ran it into the side of the upstand of the drain-pipe without any pumping, save at high tides. The end of the pipe was nearly 4 feet above the drain. This pipe had to be plugged up whenever the tide rose above it. The water was then allowed to flow into a barrel below the bottom of the excavation, and from this was pumped up into the upstand of the drain and carried off to the harbour. In this way the water has been little trouble, and not much expense. I write this for the benefit of any who may be like situated, or have similar work to execute, and also to ask the following:—

Query.—Water is scarce in the locality. It takes over 600,000 gallons to fill the tank, but it could be filled through the tile drain from the harbour in a tide or two. Would the salt water injure the ironwork of the gasholder?

J. Hall.

Gas-Works, St. Andrew's, April 18, 1878.

HYDRAULIC LIFTS FOR PURIFIER-COVERS.

Sir,—I have no wish to detract from the claim of Mr. John Reid, of the Edinburgh and Leith Gas Company, as to his being the first to adopt the hydraulic lift for purifier-covers; nor have I any wish to call in question the statements in his letter of the 8th current, as it is well enough known that he explained his system at a meeting of Gas Managers at Perth, in 1872, when it was believed by those present that he really was the inventor of the system. But, nevertheless, is it not the fact that the same had been adopted at the Glasgow Corporation Gas-Works prior to 1870, the date of the specification he alludes to? That is a question which can easily be answered; and, as honour should be given to whom honour is due, I shall be glad to learn if such was the case, and, if so, to whom the credit in that case should be given.

The Manager of the Glasgow works can at once settle the point in dispute, and say whether Mr. Reid has any claim to the invention for which he has hitherto had credit.

Justice.

April 25, 1878.

Reductions in the Price of Gas.—The Swinton and Mexborough Gas Company announce a reduction of 3d. per 1000 from the 1st of July next. At Hexham the price has been reduced from 5s. to 4s. 7d.

Rochdale Corporation Gas-Works.—The *Rochdale Observer* of Saturday last remarks: "The ratepayers will be glad to learn that the gas profits for the year ending March amount to the handsome total of £8622. This large sum will, of course, be applied to the improvement-fund, which really means to the reduction of the rates. Such a result of the year's working is the more satisfactory because we had, in August last, a reduction of 6d. per 1000 in the price, and, owing to the depression of trade, we have had a falling off in the consumption amounting to about a million and a half compared with the previous year. In times gone by, the public used to regard a rise or fall in the consumption of gas as a fair indication of the prosperity or otherwise of the town, and it is no doubt a good gauge of our progress; but it often used to be accompanied by a falling profit instead of an increased one. We are now, no doubt, reaping some of the advantages of the improvements which were introduced some years ago, and which must have reduced the cost of manufacture. A reduction rather than an increase of the sale of gas this year shows the prudence and wisdom of the Committee in determining not to involve themselves in the gigantic outlay which the proposed scheme of erecting a new plant on another site would have entailed. The time will no doubt arrive when such an extension will be needed; but it is evidently not yet urgently required, and its postponement will give opportunity for the skilful and economical development of the present works."

Preston Gas Company.—Mr. Carter, borough accountant, has issued his yearly summary of the accounts of the Gas Company for the year ending the 30th of November last. The total income was £56,976 0s. 6d., and expenditure £40,523 0s. 8½d., leaving a balance of net profit of £16,452 19s. 9½d. The dividends declared for the year (10 per cent. on A, and 7 per cent. on B stock) took up £17,145, which necessitated the withdrawal of £692 0s. 2½d. from the reserve, leaving that fund at date £22,985 14s. 10½d. The share capital of the Company was increased by a call of £9000 on the 1st of June, and a sum of £4930 borrowed on mortgage. The amount expended on this account up to the 30th of November, 1876, was £267,443 18s. 0½d., and during the year this was increased by £17,080 14s. 6d., of which £14,138 17s. 4½d. was on account of the new offices in Fishergate and extensions in Walker Street, making the outlay of capital on Nov. 30, 1877, £284,524 12s. 6½d. With regard to the gas supply, Mr. Carter shows that the total quantity distributed during the year to ordinary consumers amounted to 252,170,200 cubic feet, at a gross charge of £19,819 9s. 9½d., less £7554 12s. 2½d. in discounts, bad debts, and abatements, leaving the net amount received for gas for private consumption £42,364 17s. 6½d. The quantity supplied to street-lamps was 15,376,400 cubic feet, at a net charge of £2306 9s. 2d. The average net price received for gas for private consumption was 40·22d., and and that for public use 39·93d. per 1000 cubic feet. The Company's financial position is thus set forth:—Capital and liabilities, £293,902 12s. 0½d.; property and assets, works, &c., £284,524 12s. 6½d.; cannel and coal, &c., £8060 16s. 10½d.; sundries, £1317 2s. 7½d. The proportions of material used in gas manufacture during 1877 have been 31·21 per cent. of cannel, 11·87 per cent. of cannel slack, and 56·92 per cent. of coal. The total increase in the consumption of gas last year was 9,268,800 cubic feet; the increase in the borough and Fulwood being 8,275,700, and in the out-townships 993,100. The quantity of gas used in the street-lamps was 285,800 cubic feet less than in the previous year, and, with the 10 per cent. reduction, results in a net saving to the borough of £303 17s. 10d. The gross revenue shows a decrease of £220 9s. 9d., and the net profits a decrease of £1231 0s. 5d. The actual cost of producing the year's saleable quantity of gas, including interest on loans, maintenance of works, and all other expenses in connection with the working of the establishment, after deducting amount realized for residuals, was 2s. 4d. (28·02d.) per 1000 cubic feet, against 2s. 4¾d. (28·88d.) in 1876. During the past ten years the Company have on four occasions resorted to the reserve-fund to make up the prescribed dividend—viz., in 1869, £1521; 1870, £15; 1874, £349; 1877, £692. In the other six years they have added to it—viz., 1867, £2143; 1868, £146; 1871, £4264; 1872, £5222; 1873, £2284; 1875, £128; 1876, £854.

Parliamentary Intelligence.

HOUSE OF COMMONS COMMITTEES.

Tuesday, April 2.

(*Before Mr.* Leatham, *Chairman*; *Viscount* Holmesdale, *Mr.* Ralli, *and Mr.* Chester Master; *Mr.* A. Bonham-Carter, *Referee.*)

LEA BRIDGE DISTRICT GAS BILL.

(*Continued from p.* 638.)

Mr. Round, on behalf of the parish of Walthamstow, said the objections urged by his clients were twofold. First of all they thought a statutory price even of 5s. was higher than it ought to be, although their objections were not so strong as when it was proposed that it should be 5s. 6d.; but, from the evidence which had been produced, no reason had been given why the Lea Bridge district should have—looking forward to the future—so large a margin in the difference of price as existed between West Ham and that district. The witnesses who represented Walthamstow were very anxious to explain what they thought had not been brought forward—viz., the extremely unsatisfactory way in which the Lea Bridge District Gas Company had hitherto dealt with them, and the indifferent gas with which Walthamstow had hitherto been supplied. They therefore thought the Company ought not to have any unusual parliamentary powers conferred upon them, they not having entitled themselves in any way to it. Beyond that point there was, however, a much larger question—the position in which the Walthamstow people would be placed by the passing of the Bill, which meant giving parliamentary sanction to the agreement which had been made between the two Companies. The meaning of that was that the two Gas Companies were to arrange between themselves, and to map out the districts suited them best, wholly irrespective of the consumers, who were the parties principally interested. So far back as 1856, the West Ham Gas Company asked for powers to supply the whole of Walthamstow, and, of course, after that it was impossible for any one else to apply for power to do the same. Subsequently, however, without any concert with the authorities in any way, they made an agreement with the Lea Bridge District Gas Company, saying, "Although Parliament has made this bargain with us, we propose to transfer a part of it to you"—whether it was the most valuable or the least valuable did not touch the principle. The proper course would have been for the parties to come before Parliament and say, "Undo what you did in 1856, and, under the circumstances, make it as it is desired by both parties." An application to that effect was made three years ago, but was rejected because Parliament decided to set its face against the Company moving out of their districts for their own immediate objects without the Consumers being in any way consulted. That was a very important principle, and therefore he asked the Committee, even if they passed the Bill, to cut out clause 64, which proposed to confirm the agreement. If the West Ham Company did not choose to supply Walthamstow, there was no power to make them; but in that case let the rights of the petitioners remain as they were. He asked the Committee not to give the Company parliamentary sanction; not to sacrifice the consumers for all time, when the circumstances might be such as would induce the West Ham Company to say: "We will supply you at Walthamstow." Witnesses would be called to prove they were willing to pay a somewhat higher price than 3s. 9d., because they thought the Company were entitled to something more because of the distance they would have to go. If the Committee passed the Bill, however, no inducement could be offered to the West Ham Company in the future, because the district would be by parliamentary authority placed within that of the Lea Bridge Company. It might be that that Company would supply at the same price as the West Ham, and, if so, the consumers would not lose anything; but he (Mr. Round) asked the Committee not to sanction any arrangement which would put it out of the power of the West Ham Company and his clients to come to some arrangement by which the latter Company could supply them. He did not ask the Committee to throw out the Bill altogether, but, when they had heard his witnesses, to take their evidence into consideration, and decide whether or not they could not, with perfect justice to the consumers, reduce the maximum price below 5s. It would be recollected that the price originally asked for was 5s. 6d., but, without any hesitation, it was brought down to 5s., and therefore, in all probability, the Company had made up their minds that a much smaller maximum would suffice. With regard to the agreement, however, it would be introducing a very bad precedent if it were sanctioned. When Parliament said a certain district should be apportioned to a certain Company, it was to be presumed it was so said in consequence of the facts having been fully gone into, and the Consumers consulted on the subject. Parliament had on one occasion declined to alter its decision, and no fresh circumstances had arisen between 1873 and 1878 to induce them to alter that decision. No possible harm could be done by refusing to give the Company parliamentary power, but an extremely bad precedent might be laid down by confirming the agreement. It might be said on the other side: "What is the use of leaving you as you are, you cannot compel the West Ham Company to supply you?" They would, however, take their chance, because they did not know what circumstances would operate in the course of time. As Walthamstow became more fully populated, there would be a greater inducement for the West Ham Company to go there; at all events, it was a matter in which the inhabitants were the parties principally concerned, and they thought there was an advantage in not having parliamentary sanction given to the agreement. It was, indeed, contrary to precedent, and would establish a vicious principle, to allow two Companies, behind the backs of the Consumers, to alter a district which Parliament had deliberately sanctioned.

Mr. Thomas Launton Cuffley, examined by Mr. Round.

I am Chairman of the Walthamstow Local Board, upon whom rests the responsibility of lighting the streets, and generally with regard to the interests of the inhabitants. When the present Bill was first brought under the notice of the Local Board, they called a Vestry meeting, which was unanimous in deciding that the Bill should be opposed. After that, Board meetings were held, and a public meeting was called by the Local Board, and we were unanimous that the Bill should be opposed. The present Company and their predecessors have supplied our district since 1868. As to the quality of the gas——

Mr. Richards, interposing, said he would take the opinion of the Committee as to whether witness was to be examined as to the quality of the gas, as there had not been one word previously on that point.

Mr. Round said he had asked the Chairman of the Company whether there had not been complaints as to the quality of the gas supplied.

Mr. Richards said there had been 20 complaints in nine years, but his objection was that not one single question had been asked in cross-examination as to the quality of the gas.

The Referee inquired what allegation there was in the petition of the Board as to the quality of the gas.

Mr. Richards: Not a syllable.

The Referee: It must be alleged in the petition whether the gas is bad, or whether the public are well or ill served, especially when a petition is made by a public body.

Mr. ROUND: Of course it is competent for me to go into the price, but can you consider whether the price is excessive or not without you consider incidentally the question of the quality. The price of 5s. may be very good for a certain quality of gas, or very excessive for a bad quality, and it appears to me that the questions of price and quality are so much mixed up together that you can hardly separate one from the other. I say that I object to have to pay 5s. 6d. per 1000 feet, as stated in my petition, when I can get supplid by the West Ham Company for 3s. 9d.

The CHAIRMAN observed that the quality would be determined by the Bill itself if it should pass, but the learned Counsel could not raise that point, as it was not mentioned in the petition.

Examination resumed: The Lea Bridge Company have not supplied us either with a satisfactory quality or proper quantity of gas, and it is undesirable we should be shut out for all time from the West Ham Company. We were not in any way parties to the agreement, but if Parliament once sanctions it, we shall be handed over to the Lea Bridge Company for ever, and that the Local Board of Walthamstow decidedly object to. We are quite content to let things remain as they are, and trust to the chapter of accidents whether the West Ham Company will not at some future time be willing to supply us. We should consider ourselves better off if supplied by them, even at an increase of price as compared with what they are charging some of their other consumers. We are prepared to pay a differential rate of 2d. or 3d. per 1000 feet, or something of that sort, as compared with the rest of the district.

Mr. ROUND: Looking at your present position as regards supply, would you—the Local Board—if you are not precluded, be disposed to have gas-works of your own?

Witness: That would require consideration. We should feel inclined, probably, either to have gas-works of our own, or to apply to some others to come into the district, which will be impossible if these gentlemen obtain parliamentary powers.

WEDNESDAY, APRIL 3.

Mr. *Cuffley* recalled, and cross examined by Mr. RICHARDS.

The Local Board of Walthamstow have been in existence for about four or five years, and, therefore, the Companies could not have gone behind the back of the Board when they made the agreement. We have no *animus* against the Lea Bridge Company; but we are bound to protect the parish from very much higher charges than our neighbours are paying. At the Vestry meeting, the terms of the resolution, that "Unless the promoters of the Lea Bridge Company's Bill assent to the standard rate of dividend being fixed at 6 instead of 10 per cent. per annum, and the standard price fixed at 4s. 6d. instead of 5s. 6d. per 1000 feet, or such term or terms as the Committee may approve of, this meeting is of opinion that the Bill should be opposed in Parliament." It would be unreasonable to ask the Committee to reject the preamble altogether if it be so altered as to be satisfactory to the parish with regard to the clauses. I cannot say how we propose to supply gas at a lower price. We could start a Company of our own, or there are other Companies who could be applied to for a supply, and who are quite as near as the West Ham Company. That Company have power to supply us; but they make an agreement by which they undertake not to exercise that power, and this places the parish in an unsatisfactory position. I cannot say whether we can compel the West Ham Company to supply our district.

Mr. RICHARDS: Supposing the population of West Ham to be 100,000, and the population of Walthamstow 12,000, and supposing the standard price at West Ham to be 4s. 6d., do you think 5s. would be an unfair price for so comparatively small a concern as the Lea Bridge Company?

Witness: I should say 5s., with a standard dividend of 10 per cent., would be most onerous, and would bring our price to double what the West Ham Company are charging their customers.

Ten per cent. is upon the old capital only. Do you think it possible to supply a small district like Walthamstow, consisting of something under 20,000 people, on the same terms on which you can supply a concentrated population, like that of West Ham, of 100,000?—I think the Company would be entitled to some little increase.

Re-examined by Mr. ROUND: Mr. Richards has taken 4s. 6d. as the price at West Ham; but the fact is they are charging 3s. 9d., with the possibility of its being reduced to 3s. 6d., and in that case the disparity would be all the greater. To some extent it might be an advantage to be supplied by a Company under Parliamentary restrictions; but those advantages are not sufficiently great for us to wish to see this Bill passed with so high a price as 5s., and with the standard they propose as to dividends. The inhabitants of Walthamstow were not consulted in any way with reference to the agreement, and, therefore, it was made behind their backs, and no doubt the Companies considered it a good stroke of business. If the Bill is thrown out we could apply for power to supply ourselves, although there is no doubt the West Ham Company would oppose any other body than the Lea Bridge Company applying for statutory powers.

By the REFEREE: We complain of insufficient quantity, inferior quality, and a higher price than has been charged in the neighbouring districts.

Mr. RICHARDS said those charges were positively untrue, and he trusted he might be permitted to recall the Engineer to rebut them.

Mr. *James Higham*, examined by Mr. ROUND.

I have resided at Walthamstow for 20 years, and am more largely interested in house property there than any other person in the parish. I have taken part in all public meetings in Walthamstow during the time I have resided there. I have built about 50 houses near the church, averaging in value from £700 to £1200 each, nearly all of which are sold to gentlemen who occupy them, and who go backwards and forwards to London daily. I have had opportunities of hearing their opinion, which is one general complaint of the gas supplied by the Lea Bridge Gas Company. I have been the best friend to the Company in the parish, inasmuch as I have in each case laid the gas on all over the house; but in two or three cases the parties are so dissatisfied that they will not use it. At the same time I have increased the rent-roll of the Company more than any other person. A gentleman who paid them £24 a year was so dissatisfied that he——

The CHAIRMAN: That is not alleged in your petition, and you are, therefore, precluded from entering into that matter.

Examination resumed: The population of the parish of Walthamstow in 1851 was 4700; in 1856—at the time the West Ham Company obtained their power to supply the parish—it was 5400; in 1861 it increased to 7100; in 1871 it was 11,000 odd; and, certainly, it is largely on the increase now. We have four railway stations in the parish, and the station-master at Hoe Street told me they issue 560 season tickets annually, besides from 250 to 300 weekly tickets. All round Hoe Street station there are literally hundreds of sites ripe for building purposes, and I am speaking within bounds when I say that the population of the parish will be nearly trebled in the next 20 years. We are only seven miles from the City, and we are the first outlying district where there are large plots of land which can be built upon. Each year, as the population increases, it becomes a more attractive district for a Gas Company to supply, but the consumption would increase to a much larger extent if we were supplied by the West Ham Company. They are within about half a mile of Walthamstow at one point—viz., at Park Place [pointing it out on the map]. They also supply a mile and a half beyond it—viz., at Woodford—at 3s. 9d. per 1000 feet. The allegations in the petition presented in 1873 were about the same as those in the present petition, and it appears to me that there is no reason why Parliament should sanction this proposal now when they refused it in 1873. Just before the Committee met in 1873, I went with the Chairman of our then Local Authority, the Highway Board, to the Deputy-Chairman of the West Ham Company to ask him about the agreement, and he said they knew very little about it at the Board; that they had plenty of consumption for their gas, and did not care much about the outlying districts; and we believe we were handed over by some arrangement made in that way. Speaking on behalf of a considerable number of the inhabitants, we say that the Bill ought to be thrown out; but, supposing the Committee should think that the Bill must be passed, then we ought to be placed upon something like terms, so that we could get a supply from the West Ham Company. Woodford and Snaresbrook only pay 3s. 9d., and they have an equally sparsely populated district. I think we could induce the parish to pay an extra 9d. per 1000 feet to West Ham, (because they might have to lay some larger mains) and that would put us at 4s. 6d. I have had some little experience in Committees, and I say that the agreement is a violation of an arrangement with Parliament. The West Ham Company ought either to apply to Parliament to be relieved from their power of supply, or they ought to exercise it, and not not be a dog in the manger. In their notice, the Lea Bridge Company state that the object is to confer upon the Company the necessary powers and authorities for the supply of gas, and for all purposes, and to the exclusion of any other Company now authorized to supply gas within the district, and, therefore, the object is to shut anybody else out. I also submit that the idea of fixing the standard dividend at 10 per cent. may be very well for the Metropolis, but it is quite out of the question in a district like this. It is unreasonable to suppose, especially with the prejudice there is against the Lea Bridge Company, that the Company could increase their dividends materially, because to do so they must lay out further capital. As to the lighting arrangements, we are obliged to have our lamps in many cases more than half as far again apart as they should be for the public safety, on account of the objection on the part of the parish to the charges for gas supply. The Committee will also observe that, under the present Bill, it is not stated that the extra capital is not to receive 10 per cent. dividend, and, unless 4s. 6d. is made the maximum charge—their dividend being only 6 per cent.—they could immediately raise the price by 1s. 4d. I know it would be suicidal, but that is the working of the clause. They could raise the price to 6s. 10d. per 1000 feet. We certainly should not get a reduction in the price from 5s. within 15 years.

Cross-examined by Mr. RICHARDS: I say that 10 per cent. is very well for a Metropolitan supply, but not for Walthamstow, because they have to carry a main in some cases along a road, and only, perhaps, supply three or four houses.

Mr. RICHARDS: If Walthamstow, as you seem to anticipate, develops tolerably rapidly, that would hardly be the case, would it?

Witness: Yes, it would; because, although I have put gas in my houses, that is not an example which has been followed by others. The estates are being cut up and sold to make the most of them, and the people who will inhabit those houses are a class who will not have the gas laid on. Our public lighting would, however, increase materially.

For private purposes Walthamstow is not so rapidly increasing a place as you seem to think?—Certainly not, while the present Company supply them. It would increase much more largely if the West Ham Company supplied them.

The CHAIRMAN: Before going further, I should like to know what is the position of the inhabitants on the white portion of the map. Have they ever been served by the West Ham Company, and at what price?

Mr. RICHARDS said they never had been served by the West Ham Company, and that Company were under an agreement now not to serve them.

Sir. M. WELLS, on behalf of the Leyton Local Board, said the case of that Board was entirely distinct from that of Walthamstow. At the outset, he wished the Committee to understand that they were called upon to repeal the West Ham Company's Act, and to reverse the decision of Parliament in 1873, and he had to ask them upon what grounds they were prepared to reverse that decision. If the Committee would refer to the Bill of 1873, they would see that the agreement mentioned in that Bill was precisely the same as that incorporated in the present Bill, and, he asked, upon what evidence were they now to decide that an agreement should be sanctioned, which would have the effect of doing away altogether with the parliamentary power of the West Ham Company in the district which he represented? Not only the Local Board of Leyton, but an overwhelming majority of the whole parish, determined to oppose the Bill, though most of them were paying only 3s. 9d. per 1000 feet for gas. They felt the injustice to the other portion of the parish, and when the question came before them decided by something like 900 to 300 that the Bill ought to be opposed by the Local Board, representing the entire parish and district. With regard to the price, it must be remembered that the Company were at present without parliamentary powers, but the moment they were incorporated and had a parliamentary status their property became more valuable, and they were in a totally different position in every respect from what they were at present; and therefore the Committee would see beyond all doubt that 5s. was not the sum which should be inserted in the Bill. Under the West Ham Company's Act of 1856, the whole district was included, and it was rather a strong measure for a party to obtain parliamentary powers and then, behind the backs of the public, to enter into an agreement to get rid of the liability to supply gas to a portion of that public. The mains of the West Ham Company were on the very edge of the Leyton district, and why should the latter pay for 20 years, say, 4s. 6d. or 5s. per 1000 feet for gas because it might cost more money to supply such a district as Walthamstow? Why did Parliament in 1873 refuse to pass the Bill, except that there was no ground whatever for releasing the West Ham Company? It was not a question of competition, but it was a question of parliamentary powers being given over a district; and then the Committee had to see what additional reasons existed now than those which existed in 1873. Taking the evidence of the Chairman of the Lea Bridge Company, and the Engineer of the West Ham Company, there was not one word from beginning to end pointing out any reason why the Leyton district should be free from the West Ham Act, or why the West Ham Company should be free from the liability of supplying that district with gas. The promoters had called the Chairman of the Company, who said that under certain circumstances he would take less than 5s. They had called an expert, Mr. Penny, a very able Gas Engineer, who was called on one side or other on most Bills, and they had called their own Engineer. They had not, however, called the Manager of the works, but he (Sir M. Wells) did not much care about that, because the question of the quality of the gas would not be gone into, in consequence of the petition not containing any allegation about it. He must, however, say that they ought to have called some of the inhabitants, to show that the powers

they were seeking should be granted, and that the price proposed was reasonable. They might have called the Chairman of the West Ham Company; but there was not a single person, except the Engineer, who represented the policy of the Company, and the Committee could not rely upon that evidence. The Committee were thus asked to reverse the decision of the Committee of 1873 upon the testimony of the Chairman of one Company, the Engineer of another Company, and an expert—Mr. Penny. It was well known that when a Local Board wished to oppose a Bill they were bound to take the votes of the inhabitants, and accordingly a meeting was held on the 13th of February, at which a resolution to that effect was carried. According to the declaration of the returning officer, the result was as follows:—"In favour of the adoption of the resolution, 939 votes; against, 393; majority in favour of the resolution, 546 votes." Considering there was no interest on the part of those gentlemen in reference to their own gas, and considering they had to pay the expenses of the opposition, that was a strong expression of public opinion. Complaint had been made that it was not a district which ought properly, legitimately, and fairly to be lighted by the West Ham Company, but they might have said that it was a district so expensive to light that, under the circumstances, it was better to have nothing to do with it. No evidence had been given to show that it was not a district which might fairly be lighted by the West Ham Company. The Walthamstow people objected to the gas-works, and the Leyton people thought it a very hard thing that they should have the gas-works in their parish to supply Walthamstow, because the mains of the West Ham Company were already laid down, and there was no question about the expense. The consequence of the passing of the Bill would be that for 20 years the inhabitants of Leyton would have to contribute substantially towards the works in the larger district of Walthamstow. When they were dealing with the question of the *bona fides* of the parties, it was clear that they were doing just what they thought proper in their own interests, quite apart from the question of how it might affect the public. Supposing the Committee should be of opinion that the boundary should be as proposed, there was nothing to prevent them giving to the parish of Leyton the price of 3s. 9d., because it must not be supposed that, although the maximum was 4s. 6d., if ever they applied to Parliament again they would get more than 3s. 6d. When the London Companies, who had been charging 4s. and 4s. 6d. went before Mr. Forster's Committee almost pleading poverty, the Committee decided that 3s. 9d. should be the standard price; and he (Sir M. Wells) hoped the Committee would not inflict on his clients a higher price than 3s. 9d. if they thought the works ought to remain in the district, although he did not think it would be to the interest of the public that they should so remain. The principle of the sliding scale was a very dangerous one, and was almost wholly in favour of the Companies, and that they knew. It was not desirable to place the Company upon a sliding scale which would enable them to charge 6s. 4d.; but if there were to be a charge, say, of 4s., with power to the Company to lower their rates, the arrangement would be a fairer one for the Company and a more beneficial one for the public. It might be asked, "Is not that one-sided?" for the Company would never lower their rates unless it was for the purpose of increasing their business. Supposing they had the power to charge a maximum of 4s., if they could, by charging 3s., quadruple their business, they would do it, and therefore a descending scale was a fair one, but a scale which enabled a Company to raise the price for the purpose of securing a standard dividend of 10 per cent. was utterly unjust. There was another clause in the Bill to which the attention of the Referee ought to be specially directed—viz., the reserve-fund clause, which made it perfectly absurd to talk about ever lowering the price of gas. That clause enabled them to put by a large sum of money for certain purposes in reference to future years; so that in point of fact the sliding scale would scarcely ever come into operation in such a district. In conclusion, he (Sir M. Wells) asked the Committee to withdraw the agreement from the Bill, but if it was thought desirable that the Company should remain in the district, then he hoped a price would be given which would be just, considering the position and the circumstances of the district which he represented.

Mr. *George Chew*, examined by Sir M. WELLS.

I have resided for 17 years in Grange Park Road, Leyton, in the West Ham district, and for three years have been a member of the Leyton Local Board. I have read the clauses of the proposed Bill, and oppose them simply on public grounds, representing, as I consider, the interests of the general body of parishioners. There is plenty of ground in the Walthamstow district on which gas-works could be built; in Walthamstow Marsh, for instance, there is ample space. I consider the extension of the gas-works in the parish of Leyton will be prejudicial to the interests of the public. There are some valuable houses within a short distance of the site, and it would be especially detrimental, looking forward to an increased erection of buildings. The houses in the neighbourhood let at about £100 a year. I am aware that the West Ham Company are seeking to free themselves from their liability to supply Leyton, but, at the same time, they are supplying places farther off. The operation of the Bill, if it passes, will be that my neighbours will have to pay considerably more than I do, though living close by. The price charged for the public lamps by the Lea Bridge Company is £5 18s., and by the West Ham Company £5 7s. 6d. There are 66 public lights supplied by the Lea Bridge Company, and 166 supplied by the West Ham Company. I am of opinion that, in the interests of the public, the sliding scale, which enables the Company to raise the price, on a maximum such as 5s. 6d., is unjust; but I consider that a descending scale, which gives an option to the Company, if they think proper to reduce the charge, is fair and just between the two parties.

Sir M. WELLS: If the Company, by reducing the price, can increase their business, they will do so?

Witness: No doubt. Perhaps I may make this suggestion: The Bill says the dividend to be "declared" shall be 10 per cent. It should not be "declared," but it should be 10 per cent. upon the profits, and for this reason, that the profits are not always divided, and the Company instead of dividing will go on increasing their stock, and lay out their profits for that purpose, and therefore the consumers will never arrive at the benefit of a reduction under the 10 per cent. clause.

Cross-examined by Mr. RICHARDS: I admit that the West Ham Company could not supply the Lea Bridge district without a breach of agreement, but I say that the third party—the most interested—was excluded from all concert in that agreement.

Mr. RICHARDS: Has any application ever been made to the West Ham Company to light the district now supplied by the Lea Bridge Company?

Witness: I do not know that there has been; but when we are shown an agreement that is binding between the two, we do not wish to force these people into a breach of covenant; but, at the same time, we feel the gross iniquity of the thing all the same.

Notwithstanding the "gross iniquity"—which is a strongish phrase—the result was that you obtained gas from the Lea Bridge Gas Company a good many years earlier than you would have done from the West Ham Company?—No; I do not admit that.

Mr. *James Gallagher*, examined by Sir M. WELLS.

I agree with the evidence given by the last witness, and come here on public grounds in reference to this Bill.

Mr. RICHARDS: Do you call it a "gross iniquity," too?

Witness: If you put it that way, I call it a gross iniquity that, two or three yards from my own door they should be compelled to pay 5s. 6d., while I pay 3s. 9d. We said, "As a neighbourly action, we cannot allow this Company to come in here;" so the whole parish were of opinion the Bill should be opposed. The only question was that a small knot got up an opposition, saying it would cost £3000 or £4000, but on the parish being polled, the opposition was decided upon by a large majority.

Sir M. WELLS said he had some other witnesses in attendance, but as there was no cross-examination, he would not waste the time of the Committee by producing them. He would only call one witness to give formal evidence with respect to the poll of the parish.

Mr. *Robert Thomas Wragg*, examined by Sir M. WELLS.

I am Solicitor to the Local Board. The numbers read over to the Committee are correct. We object to the Bill because we think there is sufficient ground in Walthamstow upon which they could erect works; at all events, we argue that if they place the extended works in Leyton, they should give us the same terms that the West Ham Company do.

Sir M. WELLS said that was his case.

Mr. RICHARDS, in replying upon the whole case, said that language had been used which, he could not help thinking, was somewhat discreditable. The agreement between the Companies had been spoken of as a piece of "gross iniquity." Nothing was gained by using that sort of language, and it was extremely unfair to apply such remarks to the gentlemen who had the conduct of those two Companies. The facts of the case were that the West Ham Company, having been established a certain number of years, found it did not answer their purpose to go into the thinly populated district included in their parliamentary area under the Act of 1856, and they entered into an agreement with the Lea Bridge Company, by which they agreed not to supply a certain district which they themselves felt they could not light, and they allowed the Lea Bridge Company to take the district. The Committee might be reminded that the West Ham Company would never have gone to that district for years and years, and the inhabitants would have been without gas if it had not been for the action of the Lea Bridge Company, and the return they received for that action had been seen from the manner in which they had been spoken of by the witnesses who had been examined. The cutting off a district in that manner was not a new idea; in fact, Mr. Penny had mentioned several instances. The arrangement which had been made was for the benefit of the inhabitants, who otherwise would have had to go without gas, because there was no means of compelling the West Ham Company to supply them. By the Act of 1871 a Local Board could compel a Company to light within 50 yards of their mains; but no Company could be expected to carry a main for the sake of supplying a single light at every 100 yards. The Committee would see that if a Local Board had power to compel a Gas Company to carry their mains over an agricultural district, it would be an absurdity. The West Ham Company had said it would cost them £10,000 to go into the district, and they had deliberately come to the conclusion not to incur the expense. Another point was, Why did the present Bill, which was rejected in 1873, come before Parliament again? It was because the West Ham Company, after mature deliberation during the last five years, had come to the determination to abide by the agreement. They said it would not pay, and, therefore, they had abandoned that part of the district.

Sir M. WELLS: As to its not paying them to light it, that applied to Walthamstow. The witnesses did not say it would not pay to light Leyton.

Mr. RICHARDS said his witnesses spoke of both districts. There was, however, the fact that the West Ham Company had deliberately entered into an agreement not to go into that part of Leyton. Could it be for any other reason than that they found it did not pay? The Lea Bridge Company came before the Committee asking for incorporation, and for the confirmation of the agreement, and the West Ham Company asked for an Act to abandon part of the district which they had handed over to the former Company because it would not pay to go into it. His learned friend urged that the agreement should not be confirmed; but it was equally binding upon both parties. The Engineer of the West Ham Company said that it would cost the Company £10,000 to go into the district; but there was one very material feature—the West Ham Company acted upon a sort of sliding scale, and charging 3s. 9d. they could a pay 10 per cent. dividend; but if they were compelled to charge more than 3s. 9d., then under their Act they could not pay so much, but had to go on a lower scale. The object, therefore, of the West Ham Company was clearly to keep their supply in the most condensed district possible, and they were anxious to get rid of what at one time they regarded as a privilege—viz., the power of lighting Leyton—and the way they did it was by handing over the agreement to the Lea Bridge Company. His learned friend had said his object was not to throw out the Bill altogether, and what reason could they have in doing so? The agreement, if confirmed, would be extremely useful; but if it were not confirmed, it would still subsist as binding between the two Companies, and it appeared there was enough before the Committee to enable them to say that the West Ham district was larger than the West Ham Company required, and that the true interest of the public was to have a separate Company supplying the portion of that district which the Lea Bridge Company supplied at present. A phrase had been used that the agreement was made behind the back of the public; but who were the public? There were no Local Board to communicate with in 1868, and, therefore, that was a wrong phrase to use.

Sir M. WELLS said there were a Highway Board and a Lighting Board.

Mr. RICHARDS said that was true, and it was also the case that neither the one nor the other was consulted; but, if they had gone to either of those Boards, they would have been thankful to get gas at any price, because they would have known they had not a chance of obtaining it from the West Ham Gas Compaay, and they must have felt that neither the Lea Bridge Company nor any other Company would enter the district unless they had the security that the West Ham Company would not exercise their parliamentary rights over the district that the Lea Bridge Company had taken possession of for the benefit of the inhabitants. Now, however, the public turned round, and talked of what the Company had done as an act of gross inequity. With regard to price, the sum of 5s. had throughout the case been most unfairly compared with 3s. 9d., whereas the proper comparison would have been between 5s. and 4s. 6d. The former was the standard price proposed by the promoters, and 4s. 6d. was the standard price of the West Ham Company, although by successful working, and by the development of the district, the operation of the sliding scale had been such that the latter Company had come down from their standard price to 3s. 9d. If the Lea Bridge Company went on prosperously, and their district developed, they would come down in the same way. The Committee had before them the actual dividend the Company had been able to pay, and the actual profits they had made. They had never divided more than 6 per cent., and had put by on an average £250 a year, which was less than 1 per cent. on their capital of £35,000. Was that an unreasonable return for money invested in a commercial speculation, and could it be believed that people would accept a Bill which was to give them less than 5 per cent. for their money, which was less than they

would obtain in the ordinary operations of trade? Persons who had watched the fluctuations in the gas market knew that the price of gas shares had of late years been subject to the most tremendous fluctuations in consequence of the apprehensions which were felt with regard to the electric light, and, therefore, the dividend of 6 per cent. which the Company had earned was not an unreasonable return for their capital. Considering the way in which the concession had been received, it was to be regretted that the Company had made the reduction from 5s. 6d. to 5s., but the instant that 6d. was conceded it was made a standpoint for trying to squeeze them harder. Was it reasonable to suppose people could afford to take a price less than that which would pay them 5 per cent.? On one side there was a population of 100,000 or 120,000, while on the other there was only 18,000 or 20,000, and was it reasonable to believe that if 4s. 6d. was a fair standard price for a thickly populated district, 5s. was not a fair and reasonable price for a thinly populated district?

Sir M. WELLS said that if the West Ham Company applied to Parliament at present their standard price would not be 4s. 6d.

Mr. RICHARDS said there was not the slightest reason to suppose it would be otherwise, for what his learned friend stated about the Metropolis Gas Act had nothing to do with it, and was not worth disputing; but the very fact of the West Ham Company having originally 4s. 6d. as a standard price was a strong argument for the Lea Bridge Company having 5s. Looking at all the circumstances, he thought the Committee would say that 5s. was a reasonable price, and he also thought he had shown reasons why the confirmation of the agreement would not affect its existence. It was well known that the whole principle of gas legislation for the last 20 years had been most distinctly to discountenance competition in gas supply, but at the same time the Companies were placed under strict parliamentary regulations. The Committee would be doing a great kindness to the inhabitants by agreeing to what both the Lea Bridge Company and the West Ham Company asked them to do—viz., to confirm the agreement, and to say that the standard price might fairly be placed at the reduced price of 5s.

The Committee-room was then cleared. After some time the Counsel and parties were called in.

The CHAIRMAN said the Committee had found the preamble of the Bill proved, and they had accepted the price of 5s.

The clauses were then proceeded with. On clause 21,

Mr. PAINE (in the absence of Mr. Round) said his clients considered the proposed increase of capital to be excessive. There had been no evidence produced to show the necessity for it, and they considered it would prejudice them, as there would be a larger capital to pay statutory dividends upon than was required; and no evidence had been given as to what the new capital was to be expended on.

Mr. RICHARDS said it was a capital which would last for twelve years, and upon that point not one single word had been asked in cross-examination, which showed that the petitioners did not attach real importance to the question. The premiums did not go into the pockets of the Shareholders, and the Directors had no earthly object in issuing a shilling of capital that was not strictly required; but Mr. Paddon said it was required.

The CHAIRMAN (to Mr. Paine): Do you suggest a lower sum?

Mr. PAINE: I am afraid I must give way upon that point.

Upon clause 43,

Mr. PAINE asked to make the dividend of 7 per cent. applicable to the whole of the capital; or, if the Committee thought that unreasonable, that it might be 7½ per cent., with a standard price of 5s.

Mr. RICHARDS said that was the first time such a proposition had ever been made, because the Company had a statutory right to divide 10 per cent. at present.

Mr. PAINE said it was not a statutory right.

Mr. RICHARDS said that, as a rule, where they had a sliding scale, it carried with it the possibility of making 10 per cent. upon the whole capital. He thought a great concession had been made when it was proposed to limit the 10 per cent. to the old capital, and take 7 per cent. only upon the new.

Mr. PAINE said that was not giving anything, because 7 per cent. was the standard dividend allowed upon new capital.

Mr. RICHARDS: But you are seeking to alter the dividend upon the old capital.

The CHAIRMAN: I think the principle which Parliament has laid down is that the original capital should bear 10 per cent., unless there are exceptional circumstances.

On clause 60, referring to the notice to be given with regard to the testing of the gas,

Mr. PAINE proposed the words "two hours" instead of "sufficient."

Mr. RICHARDS said it might be more convenient there should be a specified time, and suggested "three hours," which was agreed to.

The remaining clauses were also agreed to, and the Chairman was directed to report the Bill to the House.

MONDAY, MARCH 11.

(*Before the Marquis of* LORNE, *Chairman*; *Mr.* STARKEY, *and Mr.* ERNEST NOEL; *Sir* JOHN DUCKWORTH, *Referee.*)

CHELTENHAM WATER BILL.

CHELTENHAM CORPORATION WATER BILL.

(*Continued from p.* 640.)

Mr. *Edward Leader Williams*, examined by Mr. BALFOUR-BROWNE.

I am a Member of the Institution of Civil Engineers, Engineer to the Severn Commission, and was formerly Surveyor of the city of Worcester and had the superintendence of works for supplying Worcester with water. I have been professionally engaged on the Severn navigation upwards of 40 years. The whole of the works for the improvement of the river, for the last 20 years, have been under my supervision. My private residence is on the banks of the river, above the outfall of the main sewer at Worcester. I certainly do not consider the Worcester water pure and fit for the supply of a town. I consider that a large population should never be supplied from a navigable river. A river is a main drain of a district, and, consequently, to a certain extent the main sewer. There is naturally a great deal of bad matter washed into the river from the surface of the land, and therefore I hold that it is against the operations of nature that water for the supply of large populations should be taken from a river. After heavy rains the Severn is charged with a considerable amount of earthy matter. At flood time I have seen one side of the river, opposite the main sewer, the colour of varnished oak, and the water on the main sewer side the colour of ink. The water is sometimes so foul that it would readily clog the filters. I never allow my family to drink it. It varies very much as to hardness. The watershed of the river above Tewkesbury is about 6000 square miles, with a town population of 250,000 or 270,000. There is, besides, a large country population resident on the watershed. I include in this estimate half the population of Dudley. Ellesmere, in Shropshire, has the smallest population of any town I have taken. The Droitwich Canal is also a means of getting rid of sewage. No filtration can get rid of gases which arise from putrid animal matter. On one occasion, some distance below Tewkesbury, the tide was running down so rapidly that my steam launch hardly made any headway against it. It was charged with filth by wholesale. The Fishery Association have been exceedingly anxious to ascertain how far the tide flows up the Severn, and I have found that it flows up to seven miles below Worcester, on the top of the spring. It then brings up the sewage that has been flowing down. In 1870 the tide overflowed Tewkesbury Weir 31 days; in 1871, 31 days; in 1872, 34 days; in 1873, 22 days; in 1874, 19 days; in 1875, 21 days; in 1876, 26 days; in 1877, 32 days. It sometimes overflows the weir in summer as well as in winter. It is the constant practice for barges to go over the weir. I have known trains of vessels half a mile long sailing over the Weir. I bring my water from Malvern rather than drink the filtered water supplied by the Corporation of Worcester.

In reply to Sir John Duckworth,

Mr. BALFOUR-BROWNE said part of the Corporation scheme was to take over the part of the Company's concern at Tewkesbury.

Cross-examined by Mr. VENABLES: Earthy matter can be entirely got rid of by subsidence and proper filtration. When a filter-bed gets choked, the ordinary course is to leave off using it for a time, and use another. I cannot recognize the specimens shown to the Committee as Severn water at all. I do not like the spring water about Worcester. There may be some good springs there, but I do not happen to know them. The spring that supplies my pump is not at all what it ought to be; and therefore I prefer paying 4s. per dozen quarts for Malvern water than drink the Worcester water. Some years ago I reported to the Worcester Corporation in favour of a scheme for getting water from the hills, but the Corporation decided against me. I am free to confess that the supply of the Severn water to Worcester is a very great boon as far as watering gardens, &c., is concerned. My evidence goes against the use of river water at all for drinking. I think even the Thames water is totally unfit for London. The Teme is better water than the Severn, but still it is not fit for drinking. I think it is impossible by chemical analysis to discover all the gases that are produced by decomposed animal matter. I have heard chemists so disagree about the analyses, that I consider the whole matter is *in nubibus*. The weir at Gloucester has had an effect on the flow of mud and refuse up the stream. The whole of the upper Severn is clear from any deposit of mud, while previous to the construction of that weir the whole channel of the river was silted up, and by this time there would have been no water communication to Gloucester at all if those works had not been erected.

Mr. *J. H. Long*, Inspector of Nuisances for the borough of Cheltenham, said on the 8th of February last he went to Upton. He took a boat on the river and went past the town, and, going close along the banks found a great many drains running in from private houses, and closet soil oozing out. He was informed that all the houses drained into the Severn, with the exception of some eight or twelve houses, which drained into a ditch.

Cross-examined: There was a Local Board at Upton.

Mr. *George Edmund Hide*, F.R.C.P., M.R.C.S., said he was a surgeon, in general practice at Worcester. He was Medical Officer of Health for the district of Martley. He had devoted much attention to water supply and sanitary matters. There were in Worcester a considerable number of cesspits and dumb wells. Those wells had been largely contaminated, and were closed by the Town Council. Owing to that circumstance, the Severn water was the only water that a large number of the inhabitants could use. All who could afford a filter used one. The poor, who could not afford a filter, did not like to drink Severn water, and would often beg well water from those who had it. He was obliged to use Severn water, but did not allow his children to drink it unless it had been boiled. In summer it was not fit to drink. It was not always of a good colour, but sometimes after a freshet was brown and turbid. That colour was not always discharged by filtration. It sometimes had an offensive smell, owing to decomposing animal matter. There was more than an average amount of diarrhœa in Worcester, and new comers were especially subject to it. He believed in summer the water was one of the causes. From the Registrar-General's returns, from 1851 to 1861 the mean population of Worcester was 29,322. During that period the deaths from typhus or typhoid were 202, or a death-rate of 6·89 per 1000; from 1861 to 1870 the population was 31,693, deaths from typhus and typhoid 274, or a death-rate of 8·64. Deaths from diarrhœa, dysentery, and cholera, from 1851 to 1860, 353, or 12·04 per 1000; from 1861 to 1870, 494, or 15·58. The total death-rate from all these diseases in the first ten years was 555, or 18·90 per 1000; and from 1861 to 1870, 768, or 24·33 per 1000. The death-rate resulting from these diseases in Worcester was about twice as great as in Cheltenham. In the prison at Worcester, where they used well water, they had not had a case of typhoid during the 13 years he had been connected with it. The cases of diarrhœa were few, and there had been no deaths. He had analyzed the water three or four times. Chemical analysis by itself was not a perfectly satisfactory guide in judging whether water was or was not fit for drinking purposes. The fact that large quantities of sewage were known to be in the water would, in his opinion, render it unfit for drinking purposes.

Cross-examined by Mr. VENABLES: He did not agree with Dr. Odling and Dr. Tidy that the water was quite as good two or three miles below Worcester as above. No doubt a great many cases of typhoid were due to sewer gas. Of the remainder, some might come from contaminated well water. Cheltenham was a town containing more well-to-do people than Worcester, and where, no doubt, the appliances of health were more available. There had been no cholera at Worcester of late years. Very likely 6-17ths of the people took the Corporation water. At this time of the year it was very fair water, but in summer it was objectionable. Colouring matter in water resulting from peat was perfectly harmless.

Re-examined by Mr. BALFOUR-BROWNE: Chemical analysis could not distinguish the excreta of typhoid or cholera patients from that of healthy persons.

By the CHAIRMAN: At the Infirmary the Severn water is not boiled before being given to the patients.

Mr. *Edward John Gibson* said he was a surgeon practising at Worcester. The only water supply in his house was from the Severn, but it was never used for drinking until it was filtered. The filters become clogged occasionally. The water, as supplied to him, was badly coloured. To drink it from the tap would be dangerous to health. His own assistant had an attack of typhoid fever, which was attributed to his drinking the tap water, which he had been warned against.

Mr. NOEL: Your objection to the Worcester water is because it is not filtered. You are content with it when it is filtered?

Witness: I am obliged to be content with it, because I have no other water on my premises. Even after I have filtered it, if it is allowed to stand for some considerable time, it becomes offensive.

Mr. *Thomas Minshall*, a member of the Town Council of Worcester for 30 years, said he was opposed to the original introduction of Severn water, because he had been previously acquainted with its impurities, and considered it unfit for drinking purposes. It was sometimes thick and turbid, and after being kept for a little time, it covered itself with a film. He owned a good deal of house property in Worcester, and found that his tenants had a repugnance to using it. The inhabitants of Worcester would not drink the Severn water if they were not compelled to do so.

Mr. *A. W. Knott*, a solicitor at Worcester, said he knew of no case in that

town where the Severn water was used for drinking purposes without being previously filtered. Poor people who could not filter it, boiled it; and there was general dissatisfaction with it.

Rev. *H. Kynaston*, the principal of Cheltenham College, said he should certainly disapprove of the Severn supply for the town. He had been on the river at Tewkesbury, and seen how dirty it was. The feeling in Cheltenham was strong against the scheme. If the supply was transferred to the Corporation, he would have confidence in their management. He thought it very important that the supply should be in the hands of the public body. He would not like his boys to drink the Severn water, as their healths might be affected.

Dr. *Morley Rooke*, a physician practising in Cheltenham, said he was against the introduction of Severn water into Cheltenham. There was a very strong feeling in the town against its introduction, as far as he had been able to test it. If it were to be introduced, it would be a very serious injury to the reputation of the town, and, consequently, its prosperity, and it would be an actual injury in the possibility of conveying disease. During the last epidemic, cholera was prevalent in most of the towns on the Severn bank. Cases occurred at Tewkesbury and Gloucester, also at Upton. There was not one case in Cheltenham; but he doubted if a like clean bill of health could have been presented if Severn water had been supplied. There was a strong suspicion that cholera followed the course of rivers, and that water was a carrier of disease. He did not believe the ordinary filtration which Companies gave would make the Severn water a good potable water.

Mr. VENABLES: During some years, when the smell of the Thames was perfectly intolerable in these rooms, was it not clear that no disease was traceable to it except people were foolish enough to drink it?

Witness: I mean if the germs are present in the atmosphere, the river acts as a conveyor.

Mr. *Brook Smith*, one of the masters of Cheltenham College, said he had under his charge one of the large College houses, with nearly sixty boys. He was deeply interested in the question of water supply. He thought the supply should be in the hands of the Corporation, because they would study the general benefit of the town, and would not take the question of dividends into consideration. In 1865 he remembered the feeling excited by the proposal to introduce Severn water; it was exceedingly strong then, and was as strong now. Hearing that there was a possibility of getting pure water, he would prefer the Corporation scheme to that of the Company. Before 1865 he paid £8 8s. a year, but after 1865 his water-rate was increased to £20 16s. His premises were enlarged, but the consumption, on the whole, was rather less. Any further raising of the rates would be very prejudicial to the town.

Cross-examined by Sir E. BECKETT: He could not say how the Corporation were to be able to supply water more cheaply than the Company. He knew nothing whatever about the Severn water; he simply would not drink water through which sewage had passed.

TUESDAY, MARCH 12.

Dr. *W. Thursfield* said he was Vice-President of the Birmingham and Midland Society of Medical Officers of Health, and the author of several works on sanitary matters. He was also Medical Officer of Health for a district round Shrewsbury, with a population of 200,000, and containing 21 sanitary authorities. Shrewsbury, Ludlow, and Much Wenlock were in this district. He had paid much attention to the question of water supply in relation to health, and considered the use of river water, impregnated with sewage, improper and dangerous, and opposed to precision in the use of medicine. Severn water was used at Shrewsbury, but he had warned the people against using it for drinking purposes. The population of Ludlow on the Teme, a tributary of the Severn, did not use the water for drinking, and were proposing to go to the hills for a supply. He did not consider the Severn at Tewkesbury a fit water for drinking purposes.

Cross-examined: By contaminated water, I mean water contaminated by human excreta. No water that has been thus contaminated is safe for drinking purposes, and no distance of flow removes the danger, though it may lessen it. The effect will continue for 100 miles. I have seen cases of typhoid fever caused by drinking Severn water, but at what point the infecting excreta was received into the river I cannot say. I do not believe in well water in towns, and, as a rule, would prefer Severn water.

Re-examined by Mr. BROWNE: Typhoid at that time did exist above, at other places. He believed that the excreta of a typhoid patient might contaminate water without its being liable to discovery by analysis. In his experience he had known the excreta from a typhoid patient thrown into a large body of water, and, percolating several yards through the soil, it specifically affected a well, and typhoid fever picked out the persons who used the well. No analysis of the water was taken that he knew of, but analysis would not have detected the presence of the poison. He knew this, though no analysis was taken.

Mr. *J. Watton*, a surgeon and magistrate of Shrewsbury, member of the Town Council and of the Severn Board of Conservators, said the Severn flowed past the end of his garden, and he had daily acquaintance with it as a boating man and an angler. The question of water supply had been long under consideration by the Shrewsbury Town Council. The Corporation had purchased the works, and were making inquiries with a view to the abandonment of the Severn as a source of supply for drinking, and going to the Stretton Hills. Some years ago Dr. Farr, the Registrar-General, attended the Town Council, and made a report as to the water supply, which was published in the Registrar-General's report. He knew that typhoid had occurred at the prison, and that there the Severn water was laid on. In one specific case the surgeon attributed the attack to the drinking of the Severn water. In 1853, Mr. Rainger was sent down by the Board of Trade, and condemned the Severn water. He knew the town of Bridgnorth, below Shrewsbury. The people did not drink the water, and notices were issued by the Town Council cautioning against the use of the water. He produced copies of this notice. As one of the Board of Conservators he knew that attention had been called last year to the pollution of the river, and even above Shrewsbury the river was very filthy. In a run down to Worcester, on the 2nd inst., he counted not less than 40 dead animals.

Mr. BROWNE: Do you think the Severn at Tewkesbury a fit source of supply for Cheltenham?

Witness: Certainly not. I believe its introduction would be the ruin of the town, if it became known that the town took its water from the Severn. At present Cheltenham is the healthiest town in England, whereas Worcester, which is upon the Severn, has a much higher death-rate.

Cross-examined: I know that the Shrewsbury death-rate is very high, and that Cheltenham is the healthiest town in the kingdom. I do not say that nothing is required at Cheltenham, but while there are Artesian wells and Abyssinian pumps there can be no need to go to the Severn. The water is not filtered at Shrewsbury, but it is taken above the sewers outfall. The stream from Ironbridge enters the Severn above Bridgnorth. The case of typhoid at the gaol was, in the opinion of the gaol surgeon, due to drinking Severn water. He believed that was the case.

Re-examined: An inquest was held in the case of the death of the prisoner at the gaol, and the verdict of the jury was to the effect that the death arose from typhoid, and they recommended that the water from the Severn, which had already been reported against by Dr. Farr, should form the subject of further inquiry. At Shrewsbury they had a double service —the water from a spring, which they recommended for drinking purposes, and the Severn water. But there was one district in which the spring water could not be supplied, and, when disease broke out in the town, medical men knew that there they could put their fingers upon the origin of it. The district was also a poor one. The Severn water at Shrewsbury was unfiltered, and so was that to which he had referred at Bridgnorth.

Rev. Dr. *Morton Brown* said he had lived in Cheltenham for upwards of 35 years, and had opportunities of ascertaining the feeling of the town. He signed the memorial sent in to the Corporation, and a large number of his fellow-townsmen also signed it. It was with a view of inducing the Corporation to acquire the powers of the Water Company. He signed that memorial with reference both to the present needs and future prosperity of the town. He thought the transfer to the Corporation was financially and sanitarily desirable. The Company would naturally seek largeness of dividends, while the Corporation would look at the supply in relation to the needs of the town. Sanitarily he looked at it that, being in the hands of the Corporation, they would study to supply the poorer as well as the richer parts of the town. Seeing that the town were anxious to purchase the works of the Company, he did not think it right for the Company to wish to go on supplying the town. He took part in the movement in 1865, against the introduction of Severn water, and was present at a public meeting in that year, and spoke. The opinion he held then he held now. During the interval he had had a conversation with the Company's Engineer, and he had represented that it was impossible to obtain a sufficient supply from the hills, and he was then shaken in his view, thinking that the Severn supply might be useful as a supplementary supply, still keeping the springs from the hills for drinking purposes. But hearing that a sufficient supply could be got from the hills, and that they did not need the Severn as a supplementary supply, he still held his former opinion, and that the town did not wish it. He thought the introduction of the water, the town not wishing it, would be very injurious. He attended a meeting in December last, and seconded a resolution in favour of purchase of the water-works. The resolution was adopted unanimously.

Cross-examined by Mr. VENABLES: He believed it would be a dire day for Cheltenham if the Severn water was introduced. He believed an ample supply of water very desirable, but he had the evidence of engineers that that supply could be obtained from the hills.

Re-examined by Mr. BROWNE: If the Severn water was going to be introduced, he should like it upon the separate service, but he hoped it would not be required.

Mr. *Johnson Brown*, Blenheim House, stated there was a very strong feeling in the town against the introduction of the Severn water. The feeling could not well be stronger. It had become very distinct within the past week.

Cross-examined by Mr. VENABLES: He had only seen the Severn as it flowed down its course. He had not seen the filtered water until now, and would not like to drink it unless he wanted an emetic. He looked upon the river bed as a sort of cemetery for dead animals.

Mr. *Robert Mallory* said he had lived 54 years in Cheltenham. Was formerly a member of the Board of Commissioners, and now of the Leckhampton Local Board. The feeling against the Severn water was very strong in Cheltenham, and he thought the Corporation should have the supply of water in their own hands. He was sure that the people would never be satisfied to drink the river water, and if it were introduced it should be as a supplementary supply on the separate service. They required water for Leckhampton, but were quite content to be put on the same terms as Cheltenham, or to have the price, in case of dispute, settled by arbitration. It would be a great advantage if there was a better supply to the poorer districts, which would be more likely to take it if the supply was in the hands of the Corporation.

In cross-examination, he said that he knew nothing of the powers of the Corporation with reference to the Company, nor whether those powers had been exercised.

Mr. *T. Sanders* said he had been in business for 22 years, and his firm (Messrs. Engall, Sanders, and Co.) were extensively engaged in house-letting in Cheltenham. He had heard frequent complaints as to the conduct of the Water Company, more particularly as to fittings, and he thought they were arbitrary in that respect. He knew cases in which parties had been put to large expense to change their fittings, and people had in consequence cut off the water. After their Act of 1865 the Company raised their rates, and since then they had been much complained of. There was a strong desire to get the works into the hands of the Corporation. He was instrumental in starting the memorial to the Town Council. Called on 131 persons, of whom 127 signed.

Cross-examined by Mr. VENABLES: He told those he called upon it would be conducive to the good of the town for the Corporation to have the works. He believed they would ultimately be a source of revenue to the town. Some of the Shareholders considered the price already offered to the Company not only a fair but a liberal one. He did not believe that they would get more by arbitration. He could not say that the Company had insisted upon anything illegal in their requirements.

Sir J. DUCKWORTH: We have heard nothing before of any offer having been made.

Mr. BROWNE said the fact would be put before the Committee.

Mr. *J. B. Winterbotham*, solicitor, said he had lived 54 years in Cheltenham. For many years he was a member of the Board of Commissioners, and was chairman of the Finance Committee of it. Was also on the Town Council. He was a member of the Public Health Committee, and had taken great interest in the water supply of the town. The Board made a requisition upon the Water Company, as far back as 1854, to supply 400,000 gallons of water a day; and in 1863 the question was again before them, attention being called to the insufficiency of the supply, and the abstraction of water from the sand-bed. A resolution was passed, and there were negotiations for the purchase of the works, which unfortunately ended in nothing. Then came the application for Severn water. It was strongly opposed by the town, and public meetings were held against it. The opposition of the Commissioners was in consequence of that feeling, the strength of which was admitted at the time by the Chairman of the Company in a report to the Shareholders. A rent-charge of £4500 was afterwards agreed upon as the price of the works, but the purchase went off on a question of rating, the Company considering their security injured by the exemption of the houses not taking the water. When the Company presented their Bill, there was also a proposal to take water from the Cerney Springs as a competing scheme, but it was very exceptionally thrown out on a second reading. The Company went for the Severn water in consequence of this proposal; that was admitted by the Chairman. It was the practice of the Water Company, whenever another scheme for getting water was proposed, to threaten Severn water, as a sort of dose of physic. The Severn was altogether unnecessary. A sufficient supply for street-watering, &c., could be obtained from the sand-bed. The

Corporation at present had no means of supplying baths, for which frequent application had been made. They could supply the water at a lower rate than the Company, as they would have no profit to seek for, and could borrow the money required on a town rate. The Company had screwed up their charges since 1865, so as to pay a much larger dividend without any further supply of water, still only supplying one-third of the houses in number, though two-thirds in rateable value. Many consumers of water had given up the Company in consequence of the charges, and he gave instances to this effect. The feeling of the town was decidedly against Severn water, and he believed it would be very prejudicial to the interests of the town. Whether the feeling was a prejudice only or not, it was very desirable that the water supply should be in the hands of the town. The Corporation were prepared to treat with the Company on good terms, either to take their works by arbitration, or to treat direct. The Corporation had made a liberal offer, and he believed if the Committee of Management had submitted it to their Shareholders, they would have accepted it.

Sir E. BECKETT: I will not discuss terms which may come to arbitration, but the Company's dividends have increased since 1864?

Witness: Yes. They were short of water then as they are now. The Tewkesbury works have not improved the Company's financial position; Cheltenham has paid for the loss on Tewkesbury. The Company have increased their dividends by increasing their rates, without any increase of supply.

Mr. *E. T. Brydges* said he was Town Clerk of Cheltenham, and was previously Clerk to the Town Commissioners. There had been frequent complaints as to the inadequate supply of water. In 1865 application was made to the Company to provide a supply for houses in Coach Road and Millbrook Street, but no supply could be obtained because the Company insisted upon making a charge for closets, and the total rate was more than the 2d. per week which the Corporation were allowed to impose under the Public Health Act. He had had a letter from the Clerk to the Company declining to supply the cottages unless they also supplied closets. That was in the time of the old Public Health Act. Since the new Act had been in operation, application had been made in the case of Leighton's Row, and then the Company proposed to charge £4 0s. 6d. on a rental of £56. They were only entitled to charge £2 16s., and the difference between the two amounts was the charge for closets. Under the new Public Health Act power was given to apply to the Local Government Board, under certain circumstances, to say whether the charge of a Company was a reasonable one. Application was made in this instance, but the Local Government Board stated that they had no power to interfere, there being a local Act in operation, and so, practically, the powers of the Corporation were nugatory, except so far as the supply could be put on for drinking purposes. As a fact, the mains were not carried into Millbrook Street until two months ago. As to fires, the Company had not been able to comply with the requirements to lay down mains in the private streets, of which there were about ten miles in Cheltenham, because they had no power to break up those streets.

Sir J. DUCKWORTH: Then no blame can be attached to the Company if they do not do so.

Witness: I am not imputing it to them as blame, but as a fact.

But the Corporation would have no such power?—Yes, they would.

Mr. BROWNE: That is the very point which we wish to bring out.

Examination continued: He was engaged in the contest of 1865, in consequence of the illness of his partner, the then Clerk. He heard the decision of the Committee, and it was decided, when the Company refused to supply the water on the dual service, that everything in the Bill relating to Cheltenham should be struck out. In consequence of this the Commissioners Counsel left the room, the business not further concerning Cheltenham. Was much surprised, when the Bill came to be printed, to find that all the clauses were not struck out. The Company had thus obtained the proviso with regard to an extra charge for closets and to the fittings, and both these had been used in reference to Cheltenham.

Cross-examined by Mr. VENABLES: He did not consider Cheltenham affected by the power of the Company to take the three million gallons from the river, as they had no power to bring it to the town. The Corporation had power to enter the private streets for the purpose of laying down mains. [A long and technical discussion here ensued between Mr. Venables, Mr. Michael, and the witness, on this point, but, ultimately, the witness's view of the law appeared to be admitted.] He thought the possession of these works should be in the hands of the Corporation, and this was an illustration of the principle; the Corporation being responsible for the suppression of fires should have control of the water.

Mr. VENABLES: There is nothing exceptional in the case of Cheltenham? Yours is an argument why all Companies should be in the hands of the Corporations?

Witness: Just so.

Re-examined: The possession of the water supply would be a great advantage; the supply of closets should be put on the same terms as that for drinking.

Mr. *George Parsonage* said he was Chairman of the Water Supply Committee of the Town Council, and for 24 years a Member of the Improvement Commissioners. He was formerly in a large way of business as a builder, and had much house property in the town. He had taken great interest in the question of water supply, and in 1865, as High Bailiff, presided at several meetings against the Severn water. The feeling was then almost unanimous, and he believed it to be as strong now. The feeling was also strong that the works ought to be in the hands of the Corporation. That feeling culminated in a memorial to the Town Council in favour of their acquiring the means of supply. It was signed by 850 persons, and was generally representative. A Committee were appointed, and negotiation for purchase attempted; but they could get no terms from the Company. The Corporation offered arbitration, but it was refused, and they then made a second effort to come to terms, but without success. At the statutory meeting of ratepayers, they were unanimously in support of the Corporation, and against the introduction of the Severn water. He then explained the source of the dissatisfaction felt towards the Company with regard to the fittings, which were unnecessarily expensive and arbitrary

By Mr. VENABLES: The Company had no interest in imposing expensive fittings.

Mr. *Andrew Paul* said he was Chairman of a Committee appointed in 1870 on the water supply. The Surveyor then submitted a plan for the supply of water for public purposes, and to the poorer districts, but seeing that its carrying out would involve a large expenditure, and place an obstacle in the way of the future acquisition of the Company's works, an effort was made to approach the Company.

Mr. BIDDER: And do you share the almost unanimous wish of the town, that the works should be in the hands of the Corporation?

Witness: Most decidedly. The answer of the Company at that time was that they had no desire to sell. They declined to suggest terms, and the Commissioners could get no further; but expressed their regret at the result. The reasons for a transfer of the works remained now as they did then. He was not satisfied with the rates of the Company, in which there had been a great increase. An abundant supply in the public hands would be a great boon, the Company being able to make what terms they liked for an article of which they had a monopoly. In the case of the Grammar School, for which he was concerned, an expense of £25 had been compelled for new fittings, and the rate had been raised from twelve guineas to £20, though the number of scholars had diminished two-thirds. He knew cottages rented at £8, for which the charge was 12s. a year, and no supply to the closets. He was concerned in the movement against Severn water in 1865. He believed its introduction would be a ruinous thing for the town.

By the COMMITTEE: I do not say that in 1870 we were at all satisfied we could get a sufficient supply. I am so satisfied now. That opinion is based on the evidence of an eminent Engineer, Mr. Bateman.

Dr. *E. T. Wilson*, F.R.C.P., said he had been for many years engaged in the collection and publication of sanitary statistics with reference to Cheltenham. He knew the Severn. He thought it a very unfit source of supply, because the river was very impure in itself, and because he had the very strongest objection to the use of a navigable river as a source of supply for drinking purposes, if anything better could be obtained. The Severn received the sewage of a large population, and he objected to it on that ground. As to the theory that the sewage would be oxidized or burnt up, as supported by Mr. Hawksley and Dr. Tidy, he did not agree with it, and thought there was quite sufficient evidence on the other side. In case of an epidemic upon the stream, he should not like to trust a run of 20 miles as destroying the danger of infection. Even if there were anything in the theory, and an epidemic raged at Worcester, a passing barge might drop the source of infection at the very mouth of the intake. Analysis would not show if water was medically affected. He had made the subject of water supply in relation to disease one of especial study. He had not met a medical man in Cheltenham who did not hold his views as to the introduction of the water. The feeling was very strong. He had prepared a diagram of Cheltenham, showing the relation of disease to water supply, and it showed that the centres of disease were identical with the districts in which water was taken from the wells. In consequence of the Company's charges, cottages were very poorly supplied with water. A large part of the mortality was due to the want of water in the poorer parts of the town. He had himself cured disease, and had arrested diarrhœa, by merely changing the water supply of the patient. In 1868 there was a great want of water; and it was on his report of a house-to-house visitation that the Commissioners took action in the case of Millbrook Street. The cottages there were absolutely without water, and he found typoid in nine out of thirteen houses. He did not succeed in getting the mains put on at that time, and they were not laid down, in fact, until the present application had been made to Parliament.

(*To be continued.*)

Legal Intelligence.

EAST SUSSEX QUARTER SESSIONS, LEWES.

TUESDAY, APRIL 9.

(*Before the Earl of* CHICHESTER, *Chairman, and other Magistrates.*)

THE CORPORATION OF BRIGHTON, *Appellants*, *v.* THE GUARDIANS OF THE POOR OF THE STEYNING UNION, *Respondents.*

ASSESSMENT OF THE BRIGHTON CORPORATION WATER-WORKS.

This was an appeal by the Corporation of Brighton against the assessment of so much of their property in the water-works supplying the town of Brighton as is situated in the parish of Preston, which had been raised from £1800 to £4000.

Mr. E. CLARK, Mr. FINLAY, and Mr. HOPE appeared for the appellants; Mr. MEADOWS WHITE and Mr. LUMLEY SMITH for the respondents; and Mr. MERRIFIELD and Mr. GORE for the Overseers of the Parish of Preston.

Mr. CLARK, in opening the case, said the circumstances were of a somewhat complicated character, and there were a good many figure statements. There had been frequent communications between the parties, and he was glad to say that many of the points had been amicably settled. The water-works in question were vested in the Corporation of Brighton under the Act of Parliament, 35 & 36 Vict., cap. 86; and they were vested in them with certain powers and liabilities imposed upon them. The manner in which the financial part of the undertaking was to be dealt with was specified in the 36th section of the Act. After dwelling upon the manner in which similar cases had been dealt with by other Courts, he stated that one point upon which the Justices would, perhaps, find some difficulty was with respect to £2000 which had been paid over to the borough fund. The figures, a copy of which he would hand to his lordship, showed the rateable value in the parish of Preston to be £2732. This, with the proportion of the productive mains also in the parish, and estimated at £280, made the total rateable value £3012. It was at this amount that they asked the Court to assess the rateable value, and he thought when they came to look through the figures there would be little dispute between them. The points the Court would have to decide would be, first, whether they were entitled to deduct the £2000 which had been paid over to the borough fund under the 36th section of the Act of Parliament. Secondly, whether they ought to be rated as a matter of fact upon so much of the structural value of the works as they said were superfluous, and would not be rented by the hypothetical tenant. The question was, what the hypothetical tenant would give, and to get the rent which he would be likely to pay they must see what he would be willing to pay for in the year. What he would pay for would be what he wanted to use for that time, and if, for public purposes, the Corporation had put up works not required for present necessities, but which they would hereafter want to use, and would be a convenience to them, they, as the hypothetical tenant, would naturally say they were not liable to be rated at present for that which was now superfluous, and that they had nothing to do with the responsibility to be incurred 10 or 20 years hence. They did not enjoy the profit now, and what they had to pay for was what they used now. The third point to be considered would be whether the rate should be allowed at £4 or £5 per cent. upon the amount arrived at, and he submitted to the Court that as they were dealing in that matter with rateable value, £4 per cent. would be quite sufficient to allow as the rate to be paid for these premises.

Mr. *Edward Easton*, examined by Mr. FINLAY, said he was a Member of the Institution of Civil Engineers, and Engineer to the Brighton Water-works at the time they were in the hands of the Company, and also since they were taken over by the Corporation. They extended, in reality, over five parishes, two very small portions being in two parishes. Practically, however, they extended over the three parishes of Brighton, Hove, and Preston. Five of the seven reservoirs included in the structural works were situated in the parish of Preston, and were shown on the plan produced. In deducting, as had already been explained, the amount of £2000, which was placed to the borough fund in the year 1876, he made the rateable value £10,558. The figures £98,000, representing the structural value of the works in the parish of Preston had been agreed upon between himself and Mr. Ryde. To this an addition must be made for some land omitted from the calculation, but which he had since agreed upon with Mr. Ryde, amounting to £8000, making a total of £106,000. In his

view the structural value of the stations and productive mains which a tenant would pay rent for, was £60,300, and he estimated that the rateable value of that should be at 4 per cent., which would realize £2412. To that he had added the ground-rent, estimated at £320, which would make the total rateable value £2732. To be added to that was the proportion which the parish of Preston should receive for the remainder of the value of the whole concern. This he made to be £26,000 gross receipts, and not £28,000, to the receipts in the parish of Preston, which were only £1200. Together with this was the rateable value of productive mains in Preston, which he put down at £280, and which brought the sum total of the rateable value in Preston up to £3012. In his judgment that was the full amount of the rates to be paid during the year.

Mr. FINLAY: You state that the structural value is £98,000.

Witness: Yes, but I have taken 4 per cent. on £60,300 only, and the reason is this, that we have at Brighton in these water-works a very large excess of pumping power, and also of water-producing works, and in my judgment a tenant, a hypothetical tenant, coming to rent these works would not consent to pay rent upon at least one-half of the structural value of the pumping plant, and of the water-producing arrangement or works, and I have therefore deducted that. I have taken the structural value agreed upon between us, engines, engine-house, walls, chattels, and I have divided that by two, and deducted that from the agreed structural value, as being the structural value of the works which a tenant would really pay rent upon. Any one taking the works for commercial purposes would only consent to pay on one-half of these things.

Mr. WHITE: I have consulted with my friend Mr. Clarke, and to save what is usual in these cases, a very long inquiry, I am willing to take as the rateable value £10,558, *plus* the £2000; in other words, to argue upon the first part of the case this question only of their right to deduct from their receipts £2000. If I am right that they cannot deduct that, they will have to add the £2000 to the £10,558, making their rateable value £12,558. I will ask Mr. Easton on that point a few questions.

Mr. MERRIFIELD, on the part of the Overseers, said he had assented to that.

Cross-examined by Mr. WHITE: This estimate is, I believe, taken on the gross receipts for the year 1876. I have heard that the Corporation of Brighton hope to hand over from the water-works to the borough fund £4000 next year. They will, therefore, be £2000 richer from their water-works. But if a tenant were to come into the occupation of the water-works instead of the Corporation, he would not be £2000 the richer, because he would have to hand that over to them, or reduce the rates in accordance with the clause of the Act. The income which the Corporation derive from these works would be £2000 the better; and, apart from the Act, if the works were in the occupation of the Company, the larger the receipts the greater the rateable value up to a certain point. If the expenses remained the same, and the receipts became larger, they would be richer by reason of the occupation; and, assuming that a Water Company were allowed to make any amount of profit unrestricted by an Act of Parliament, of course, they, as the tenants of the works, could afford to pay a larger rent to the landlord. But as soon as the restriction begins to operate, and they can make no higher profit, they could not afford to pay a higher rent. In the present case the £2000 will be part of the profits actually made, and handed over to the Corporation. The rateable value of stations and unproductive mains is put down at £2732; the total rateable value of the whole concern, made up of productive and unproductive plant, is £10,558. In order to ascertain the total rateable value of the productive, we deduct from the total rateable value of the whole concern the £2732, which is the total rateable value of the unproductive, *plus* the rate on the structural value of the unproductive mains in the other parishes. That £60,300 is only in the parish of Preston. We have to add to that the total rateable value of unproductive mains elsewhere, which is £98,995. This does not include the portion which I call superfluous. There is nothing superfluous except in Preston, because the two pumping-stations are entirely in Preston. I have deducted one-half of the engine power and wells.

Mr. WHITE: What have you to add to that to make the rateable value of the whole?

Witness: You have to add to that £31,000 more, in round figures, for the unproductive mains in the other parishes; and £7500 for reservoirs in the other parishes. That is the only part we did not have time to agree upon. That is mainly the question between us.

If we treat as productive mains what you call unproductive, it would at once confuse your figures?—It would.

You have upon paper the structural value of stations and unproductive mains that are in Preston. Will you tell me what is the figure which ought to be put against stations and reservoirs if all the works under this description were brought into the rate?—I have taken the engine and boiler houses at Goldstone, £6250; the wells at Goldstone, £9500; the buildings at Lewes Road, £5800; and the wells at Lewes Road, £8500; making a total of £30,050.

If you take the whole of the unproductive plant in Preston, will it amount to about £100,000?—Yes, with the land.

Tell me shortly how that £30,000 deduction is made out.—Half of the engines and half of those items I gave you, including the wells, tunnels, and engine-houses.

Has every part of these works been in use during the whole of the year?—Every part, at different times.

Therefore, if a tenant had been in occupation, he would have used al these works?—No, he would not.

If he had been working the scheme of works as the Corporation did, he would?—Certainly, he would; but it is not necessarily so.

May I say they have been making use of the whole of the works?—Yes; they have been working the engines alternately.

Then they have not been useless to the Brighton Corporation?—They have been used; and, therefore, they have not been useless.

In point of fact, then, if we treat the tenant as coming into the possession of the Corporation, he would have used this plant if he had it?—He would have used it only to keep it in order.

The CHAIRMAN: Your point is to show that half the existing power is sufficient to provide for present needs?

Mr. CLARKE said that the fact that the plant had been used in the way Mr. Easton described proved nothing.

Mr. WHITE said he should prove it meant a good deal. (To witness:) Is it not an advantage—I do not say that, perhaps, according to your evidence, you could not get on without it—but is it not a substantial advantage in the working to have a double set of engines?

Witness: I do not think it is. My reason for saying so is this, that we at the present time contemplate drawing a report, which has for its object to do away with the Lewes Road works altogether; for the present, at all events.

You have not done away with Lewes Road altogether, have you?—No, we have not, because Goldstone was not in thorough working order until recently.

In the case of water-works where you have to give a continuous supply, is it not the case that you require more power than is absolutely necessary to meet contingencies?—Certainly. We consider that if we have a duplicate engine, each engine capable of doing the whole work of the town, that we have provided quite sufficient.

Cross-examination continued: I have already stated that the engines are all used at times. I have never known the whole four used at once. We have sometimes supplied the whole town from Lewes Road. We use the Goldstone Bottom engine at times, pumping half the water from there, and half from Lewes Road. I do not think it is an advantage to have these two sources of supply, and we are going to do away with one. Including the £2000 referred to, there is a profit of £12,600 derived from these works, allowing all that a tenant ought to keep in his pocket. Hypothetically, that is the rateable value.

Mr. WHITE: It is a question between Brighton and Preston we are discussing, because if you do not rate this in Preston on the unproductive, it must be thrown on the productive?

Witness: I do not quite understand that.

You admit that the rateable value of the whole is £12,600?—Hypothetically I do.

After putting this £2000 to the Corporation, you have £10,600 left to pay to your landlord; and you say, instead of giving Preston part, it ought to be given to Brighton. If this is the mode of dealing with your unproductive works, you are taking from Preston and giving to Brighton?—I think not. There is the deduction I made for the second engine.

If you make Preston less, you make Brighton more?—We make Brighton and Hove more.

It is the struggle that the aggregate rateable value of the works was to remain the same?—The division of them.

Let us go to the wells and tunnels. Do you say there are distinct wells and tunnels, or do you say that the amount for the tunnels and the wells is too large?—In the case of the wells and tunnels I have not deducted so much as I might fairly deduct. There are several wells at each place; several at Goldstone Bottom, and several at Lewes Road, connected by tunnels; but the water does not go into a common reservoir. We have the means of shutting off the water absolutely, and can pump from one well with one engine, and from another well with another engine. The wells and tunnels are connected at each place, and work together. It is convenient to use both stations simultaneously, and it is sometimes done.

The CHAIRMAN: All his evidence is based upon the statement that the Lewes Road works are not necessary.

Mr. WHITE said in this case he should maintain that the mere necessity had nothing to do with it, if they had rateable works in full operation.

Mr. *Joseph Quick*, C.E., examined by Mr. FINLAY, said he was well acquainted with works of this kind. He agreed with the conclusions arrived at by Mr. Easton, as to the rateable value of all the works, as well as the value of the works in the Preston parish. There was certainly more plant than was really required for use at the present time at the works.

Cross-examined by Mr. WHITE: The total value of the plant in the parish of Preston was £105,200; in Brighton, £73,000; and in Hove, £15,000.

This concluded the case for the appellants.

Mr. WHITE, on behalf of the respondents, remarked that the only question between the parties, on the first part of the case, was with reference to the £2000, and that was entirely a question of law. Mr. Easton had told them it was a part of the expenditure of the tenant, but he (Mr. White) said it was applied as a part of the profits.

Mr. *Edward Ryde*, examined by Mr. LUMLEY SMITH, said he was a Surveyor, and one of the Vice-Presidents of the Institute of Surveyors. He had had great experience in valuations and assessments for rating purposes, and also in the valuation of water-works throughout the whole of England, and he made the valuation in the present instance, which was acted upon by the Assessment Committee of the Steyning Union. When the Corporation attended before the Committee and objected to the amount at which they were rated, he was present, and the objection that there was a superfluous supply of machinery at the water-works was not then raised. The contention of the Corporation was that they ought not to be rated at all. The way in which he estimated the rateable value was by taking the amount earned in the last year, and if there had been any superfluous machinery he did not take it into account, as it earned no money. What he took into account was the actual work done, and he assumed that the Corporation, at their works, had no more than the necessary pumps and engines to do the work. He was of opinion there was not more plant in the Brighton works than would be required, if they took into account the probability of an accident. The interest on the borrowed money was equivalent to the rent which would be paid by a tenant, and the £2000 was what was actually earned.

Mr. *Barry*, C.E., examined by Mr. WHITE, said in his opinion there was no excess of power in the works of the Corporation, and he did not find such a perfect duplication of parts at either of the stations as that one could be worked without the other.

This concluded the evidence for the respondents.

Mr. MEADOWS WHITE, addressing the Court, said the case had been divided by the respondent and the appellants into two parts—one, the rateable value of the entire concern, and the other the rateable value of what was properly rateable in Preston. It was perfectly clear that the first thing to be ascertained was what was the rateable value of the whole works, and they were agreed upon the result of that, less this one point of £2000. It must be taken, and had been laid down in railways and gas-works that each part must be considered as working towards the whole. They were to look, not to any particular part, but to the whole works as one apparatus, and it was only owing to the parochial division, which was an accident of the law of this country, so to speak—it was only by the fact that in this country they were obliged to rate property in the parish in which it lay, that this difficulty had arisen. It was admitted that the Corporation should be rated upon £10,000, and he should have no difficulty in satisfying the Court that, with regard to that point of law, in which the Corporation sought to exempt themselves from being rated on the additional £2000 that the Union was right. Regarding the point of superfluity, it had never been raised before until that day, and he maintained that the respondents had the strongest argument before the Court that the parish of Preston ought to have its full share of the £3000. In support of his contention that the £2000 should be taken as a part of the profits and become chargeable, he quoted a number of cases where it had been held that such was the usual course of procedure. The question of superfluity was a very ingenious one to put forward, but he considered they must pay what was a fair rent so long as the premises were occupied; and, as they were aware, they had been occupied for years, and continued to be up to the present moment. He thought the Corporation, rather than be charged with a wasteful expenditure of their capital in needlessly maintaining two establishments, and in that manner seeming to have been acting as wasteful trustees of public funds, would like to have it thought that they were beneficially occupied in these water-works, and as they were making £12,000 a year they would not mind giving to Preston that fair proportion to which it was entitled. The only other point that he dealt with was with regard to the per centage to be charged, and he maintained it was generally made 5 per cent.

Mr. MERRIFIELD having briefly addressed the Court on behalf of the Overseers,

Mr. CLARKE replied for the appellants.

The Magistrates then adjourned to consider their decision. After an absence of about a quarter of an hour, they returned, and

The CHAIRMAN said: We have carefully considered the evidence, and have talked it over in the other room. The Magistrates are unanimously of opinion that the assessment should be confirmed, costs to follow the event.

Mr. MERRIFIELD asked if the costs would be taxed out of Court.

The CHAIRMAN replied in the affirmative.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

Major Bolton reports that the state of the water in the Thames and Lea was generally turbid and discoloured during the month of March. In the Thames at Hampton, Molesey, and Sunbury (where the intakes of the West Middlesex, Grand Junction, Southwark and Vauxhall, Lambeth, Chelsea, and East London Companies are situated), the water was good on the 1st, on the following day it became coloured, and increased in turbidity until the 9th, when it changed for the better, and improved in clearness on the 11th, and from that date it remained fairly good for the rest of the month. The highest flood state of the river at Hampton during the month was 1 foot 1 inch above summer level, and the lowest 3 inches below the summer level. Of the Companies drawing their supplies from the Thames, the West Middlesex, East London, Chelsea, and Lambeth have sufficient storeage capacity and impounding reservoirs to avoid taking in water when floods prevail; the Southwark and Vauxhall, and Grand Junction Companies, on the other hand, are not so circumstanced, but have acquired land for the construction of suitable storeage reservoirs and other works at Hampton. The Lambeth Company have given notice to commence a constant supply in a district bordered by the Kennington Park Road to the Elephant and Castle, the Walworth Road, and across Grosvenor Park and other streets, to the point of commencement at the Company's old offices, and are also giving constant supply in a number of courts and alleys.

SHEFFIELD WATER-WORKS COMPANY.

The Annual Meeting of the Shareholders was held on Friday, the 12th inst.—Mr. W. COCKAYNE, Chairman of the Directors, presiding.

The following report was submitted:—

The report of the Directors, previous to the annual meeting of Shareholders in April, 1877, explained that the alteration of circumstances, since the order made by Vice-Chancellor Malins in 1872, had created a question respecting the continued application of that order, which the Directors proposed to submit to the decision of the Chancery Division of the High Court of Justice; and that, pending such decision, the sum of £19,991 19s. 5d., which would, under the terms of the order, have been appropriated for a dividend on ordinary shares for the year 1876, was carried to a suspense account.

At the time of the last annual meeting, the Directors hoped that the decision of the Court of Chancery on this question would have been given in the course of a few months; but the great pressure of business in that Court has hitherto prevented it being obtained.

The position of the revenue of the Company for the year ending Dec. 31, 1877, is, that after payment of all expenses, and the sum of £32,885 10s. for dividends on preference shares, there would, if the interest amounting to £19,652 16s. 9d. on the capital invested in works and land, not yet utilized for the supply of water, were charged to capital, in accordance with the terms of Vice-Chancellor Malins's order, remain a balance of revenue of £19,086 19s. 4d., which would have sufficed to pay a dividend of 4 per cent., for the year 1877, on the ordinary shares, leaving £612 19s. 4d. to be added to the surplus fund. Until, however, the Court shall have decided whether the order made by Vice-Chancellor Malins be applicable to the existing circumstances of the Company, the Directors consider it incumbent on the Company to abstain from making a dividend on the ordinary shares. They therefore recommend that, for the present, no such dividend shall be made, and they have carried the before-mentioned sum of £19,652 16s. 9d. to the suspense account, making, with the amount dealt with in like manner for the year 1876, £39,644 16s. 2d., the destination of which, as between capital and revenue, awaits the decision of the Court. When this decision is obtained, the Directors will, in the event of the Court having determined that the amount now in suspense ought to be treated as part of the revenue of the Company, convene a special meeting of the Shareholders, with which will rest the appropriation of this money.

The Directors refer to the gratifying fact that a demand for the water supplied by the Company is arising in the districts surrounding Sheffield. The supply of Chapeltown is under consideration, and the Directors have undertaken the supply of the township of Dore. They are satisfied that both the extensions to Chapeltown and to Dore will be remunerative to the Company, and they believe that they are only the first instances of a demand which is certain to rapidly increase, and most materially to aid the prosperous development of the Company's undertaking.

The depressed state of trade during the past year has much retarded the increase of the Company's revenue, especially that portion of it derived from water supplied for trade purposes. Notwithstanding, however, this serious drawback, the houses supplied by the Company are 1600 more in number than they were in 1876, and the aggregate amount of water-rates for the year 1877 is £344 13s. 11d. more than that for the preceding year.

The Directors have been able to effect a considerable reduction in the amount of interest paid for money borrowed. Up to this date they have borrowed on new and renewed debentures to the amount of £455,000 at 4 per cent. interest, the whole of the Company's debentures having previously borne a higher rate. This will not only cause an annual saving to the Company of about £2000, but affords a satisfactory proof of the estimation in which the stability and security of the Company's undertaking is regarded by the public.

The Directors have offered for sale in lots, by auction, 31a. 2r. 22p. of the Company's land at Crookes Moor, a ground-rent of £17, and the site of Limerick Wheels, with the surrounding land near Hillsborough. Two only of these lots were sold, realizing prices amounting to £2175.

The Directors had hoped that purchasers would have been found for a much larger portion of this property, but they have reason to expect that a considerable part of it will be disposed of by private contract. The money produced by this property will be applicable to the capital purposes of the Company.

Messrs. Hawkeley, the Company's Engineers, report that they have made their annual inspection of the storeage reservoirs of the Company, constructed in the Redmires, Rivelin, and Loxley Valleys, and have ascertained that the whole of these works are in a sound condition and a good state of repair. The reservoirs now contain an ample supply of water to meet the requirements of the ensuing summer.

The Directors have had to regret the retirement from the Board of Mr. Samuel Roberts, who has been continuously a member of the direction since the commencement of the Company, 43 years ago. The Directors are satisfied that it is not necessary to recall to the recollection of Shareholders the important services Mr. Roberts has, during this long period, and frequently in difficult circumstances, rendered to the Company. The vacancy caused by his retirement was filled by the Directors by the election of his son, Mr. Samuel Roberts, jun.

The outgoing Board are composed of the following gentlemen:—Mr. William Cockayne, Mr. John William Hawkseley, Mr. William Sissons, Mr. Henry Crookes, Mr. Thomas Cole, Mr. Francis William Colley, Mr. Percy Smith, Mr. William Isaac Greaves, and Mr. Samuel Roberts, the younger, all of whom are eligible, and offer themselves for re-election. Shareholders are to have the power of voting by proxy at the ensuing meeting.

The CHAIRMAN moved, and Mr. HAWKESLEY seconded, a motion for the adoption of the report, which was put and carried unanimously.

Mr. BARBER moved a vote of thanks to the Directors, remarking that this compliment was the only thing by way of remuneration, that the Board received for their services.

Mr. HIDES seconded the motion.

Mr. J. WILSON inquired the amount of salary paid to the Manager, also as to the arrangements of the Company with reference to charges for baths, and whether the difficulty in respect to payments for baths had not resulted in a large arrear of outstanding water-rates. He further wished to know why, after advertising the surplus land for sale, the offer had been withdrawn.

Mr. F. E. SMITH said there was a feeling some time ago on the part of the Town Council, and on the part of many of the Shareholders too, that the works of the Company should belong to the Corporation. A proposition was made in the Town Council by the present Mayor that the Corporation should buy the works, and Mr. Mappin, who was made one of the Committee to act in behalf of the Corporation, wrote to the Company. He waited a considerable time, and eventually had an interview with the Law Clerk, by whom he was distinctly told that no purchase could be made on any terms, and that the Company were not sellers. He (Mr. Smith) thought it would have been much better to have fixed some price, even if it had been a very high one, and that, as the Shareholders had been suffering from the loss of dividends for two years, they should have been consulted before the offers of the Town Council were thrown overboard. The Water Company's shares used to be spoken of by the late Mr. Albert Smith as the Sheffield Consols, and they were looked upon as the best investment that could be found. If the Shareholders took a survey of the water-works of the kingdom, they would find there was not one which was selling below par, while many paid 10 per cent. dividend. Since they met last year the Leicester Water Company had sold their undertaking to the Corporation at something like 165 to 170 per cent., and the Shareholders had derived a large benefit from it. He thought, at least, that in a matter of this kind the Shareholders ought not to be treated like a flock of sheep, and should have an opportunity of deciding for themselves whether they would sell their works. Last year they were told that there was a 4 per cent. dividend for them; but there was a certain difficulty in the way. It would have been a payment out of capital, and have necessitated an application to the Court of Chancery. They had not had their reply yet. There was, in fact, no 4 per cent for them, nor 1 per cent. Their property was their ordinary shares, and he looked upon them at present, and for many years to come, as of no value whatever. If he were a poor man he should sell out at the present price, though he should have great difficulty in selling at 65. He quite recently offered to sell at 67½, and there were no buyers, though many sellers were on the Exchange. What were their prospects for the future? In 1874 the Company had an income from water-rates of £58,000; in 1875 it was £61,800; and in 1876, £67,000, showing a large increase each year, upon which the Shareholders were duly congratulated, and shown what a growing and improving property they possessed. In 1877 they heard that the total was £64,768, or a decrease of something like £2000. Then some one had spoken about the baths question, which he knew was a wide and a difficult one. He knew all about it last year, but did not then introduce it at the meeting, as he hoped it would be settled. He was content to pay a water-rent for his bath; but if others were not to pay for their baths, and were excused on that ground from paying their water-rent at all, why should he not also be excused? He had been charged water-rent upon his carriage-house and stables—for each horse and carriage—and, thinking the rate too large, he made a complaint to the Manager, who informed him that, as his house was rated at over £200, the amount would be abated. He maintained that it was very unjust that one person should be excused, and that another should pay. This year the Company seemed to be £600 short of paying the dividend on the preference shares. As an ordinary Shareholder, he wanted to know what right they had to pay a dividend on the late issue of preference shares when they were £600 short. Who was to make up that deficiency?

Mr. PERCY SMITH replied to the questions asked, as the Chairman was suffering from indisposition. He said the salary of the Manager was £1000 per annum, which he did not think was at all excessive. As to the use of water for baths, the Directors were being guided by their legal adviser, and they did not think it desirable to discuss the matter at the meeting. With reference to the surplus land, the sale was advertised last year, in the expectation that the Engineers plans would be got ready in sufficient time to have a good sale before the year closed. The difficulties, however, were too great, and numerous. There were many reservations to be made, and the Engineers had to be consulted with regard to all the pipes running through the land, in order that the Directors might see what they could and what they could not sell. Thus a good deal of time was spent, and, when all the preliminary arrangements were completed, it was found that too near the end of the year had been reached to have an advantageous sale. As to the point Mr. Smith had raised about negotiations with the Corporation, he really thought it was not advisable to say anything about it. The Board could only say that no proposals were ever made by the Corporation. The Corporation had shown no disposition to do anything but to try to get the Company on their backs, so as to acquire the concern as a ruined affair. The Corporation knew as well as the Shareholders that the latter had hold of an exceedingly good thing, and if the Shareholders would only have a little patience, which they were quite as able to show as the Corporation, they would realize a handsome profit in the long run. As to the question of application to the Court of Chancery, the report gave a sufficient answer. The decision would be given in due course, and the Directors must wait patiently until the decision was given. Mr. Smith had touched upon the general position of the undertaking; and, in reference to that, he would say it was sufficiently apparent to any one who was able to understand accounts, and who had a knowledge of the nature and extent of their works. The Company were incorporated with two main objects. The first and foremost was to give an ample supply of good water to the town. The second object was to give a reasonable return to the Shareholders for the employment of their capital. If, for the time being, the Company seemed to have failed in attaining the second object, it was only because thay had been determined, come what might, that they would attain the first, and give to Sheffield an ample supply of good water. They had now supplied the town with water to such an extent that, for the time being, they were rather hampered with an excess of it, and not only had they a supply for the present wants, but for a population yet unborn, and for multitudes of men and women who, they hoped, would be attracted to the town by an extension of trade. If it should turn out in the future that a mistake had been made, the mistake was that the Directors had put too much confidence in the growth of the town. He believed, however, that with a gradual extension of the town would come a gradual increase of prosperity to the Water Company; and that the Company would soon be raised to the position of a divdend-paying concern.

The motion was then put and carried with two dissentients.

The retiring Directors were re-elected, and

Mr. COLLEY, in returning thanks, remarked in reference to the income of the Company, that the quarter just closed showed an increase on the corresponding quarter of last year equivalent to something like £2000 a year. He thought, when they considered the state of trade, and saw that they could get an increase at such a time, it was fair to assume that they would have a very large increase indeed as soon as trade revived, and as soon as the improvements and extensions mentioned in the report became remunerative.

The proceedings closed with a vote of thanks to the Chairman.

WIGAN CORPORATION GAS ACCOUNTS.

The Town Clerk of Wigan presented to the Gas-Works Visiting Committee, at their meeting on the 16th inst., the following report in reference to the recent proceedings against the Corporation, before the borough Magistrates:—

Gentlemen,—The summons by Mr. Templeton against the Corporation, for non-compliance with the 35th section of the Gas-Works Clauses Act, 1871, was heard on Thursday last, and the Magistrates inflicted a penalty upon the Corporation of 3s. and costs.

I attended on behalf of the Corporation, and urged that the section in question did not apply to the Corporation, on the following grounds:—

1. The Gas-Works Clauses Act, 1847, and the Gas-Works Clauses Act, 1871, are to be construed together as one Act.

2. The Act of 1847 is divided into parts by certain introductory words, and it is enacted that for the purpose of incorporating or excepting any part of the Act, it is sufficient to refer to the introductory words.

3. One part of the Act of 1847 relates to profits of a Company carrying on a gas-works for their own benefit, and then follow a series of clauses providing for the amount of profit to be paid, what is to be done with the excess, and that when the profits exceed a certain amount a reduction is to be made in the price of gas, and power is given to the Court of Quarter Sessions to appoint an Accountant to report to the Court, and the Court may inquire into the matter and make a rateable reduction in the rate for gas. The Court has power to order the Petitioners to pay the costs in certain cases. There is a penalty for the non-production of books and vouchers. An annual account is to be made up by the Undertakers, and deposited with the Clerk of the Peace, and there is a provision as to the tender of amends.

The whole of the above provisions are contained in clauses 30 to 39 inclusive, and are all under the heading as to profits of a Company. The 35th clause of the Act of 1871 is clearly a substitution for clause 38 in the Act of 1847. The Wigan Improvement Act provides that the provisions of the Gas-Works Clauses Act, 1847, shall not apply to the Corporation as far as regards the provisions with respect to the amount of profit to be received by the Undertakers, when the gas-works are carried on for their benefit; so that none of the clauses of the Act of 1847, which I have specially referred to, apply to the Corporation; and I am of opinion that section 35 of the Act of 1871 does not apply, because it is to be construed with the Act of 1847, and is, in fact, a substitution for clause 38 of that Act.

Accounts made up under section 35 of the Act of 1871 may be useful to the Gas Committee for the purpose of thoroughly watching the progress of the gas-works; but, beyond matters of curiosity, they are of no use to anybody else, as it is quite clear that those accounts, in the case of Wigan, can never be made the subject of inquiry before a Court of Quarter Sessions with a view to the reduction of the price of gas.

The Corporation are bound to carry any balance on the gas account to, and it is to form part of, their district-fund account; and the Wigan Improvement Act throughout contemplates the dealing with the gas-works as municipal property; and the accounts of the Corporation as an Urban Sanitary Authority are, in my opinion, the only accounts which the Wigan Improvement Act contemplates being kept.

(Signed) MASKELL WM. PEACE.

NEW GAS-WORKS AT TUNBRIDGE WELLS.

The inauguration of the new works for the Tunbridge Wells Gas Company, designed by Mr. R. P. Spice, C.E., took place on Thursday last, when the memorial stone was laid by the Chairman, Edward Marchant Hunter, Esq., in the presence of the Directors and Officers of the Company, and of a number of invited guests.

The proceedings commenced with an address from Mr. SPICE, who expressed a hope that the ceremony in which they were about to take part would prove a most auspicious event to the Shareholders of the Company and to the inhabitants of Tunbridge Wells. They were engaged in a most important undertaking—an undertaking which had been initiated with a large amount of public spirit on the part of the Directors, and also with a becoming sense of the responsibility it involved. Having enlarged upon the question of the mutual interests of Gas Companies and Consumers, he remarked that in the present day a notion was entertained by many that the supply of gas to the community was the special work of the Local Authority. This idea might, however, be carried out to an unfavourable extent, and he believed that it would be unfortunate for this country when private enterprise was thus nipped and thwarted, as even now was sometimes the case. He concluded by presenting to Mr. Hunter a trowel, which he said he felt sure he would use in the most workmanlike manner in the task before him.

The trowel bore the following inscription:—"Presented by R. P. Spice, M. Inst. C.E., to Edward Marchant Hunter, Esq., Chairman of the Tunbridge Wells Gas Company, on the occasion of his laying the memorial stone of the Company's New Works, on Thursday, 25th April, 1878."

Mr. HUNTER said it might be in the recollection of some present that, a few years since, their good friend Canon Hoare, whom he was glad to see with them on this occasion, visited America, and on his return he gave a graphic description of his experience there. Among the questions he was asked was one, put with some considerable degree of doubt—had they gas in the district in which he was living in England? He was able to reply in the affirmative. In fact, gas-works were not of recent introduction in that town, for as long ago as 1835 the basis of the present works was laid. In Gas Lane, which was then Golding Street, premises had been purchased by a private individual for the purpose of setting up gas-works. The extent of that ground was 98 feet in length, by 38 feet in breadth, or less than one quarter of the size of the retort-house now erecting. For some years the works were carried on in private hands, but a Company was ultimately formed, and in 1843 the interest in the buildings, &c., and the contract with the town, were purchased. After that, additions were made to the works, but even then not making them quite so extensive as the retort-house to which he pointed. The first year the Company had the works they did not carbonize more than 400 tons of coal, but the undertaking had increased year after year, to meet the requirements of the town, so that at the present time the old works comprised something like an acre in extent. But these were found too small for the requirements of the place, and, after much consideration, attention was turned to another site, and at last they fixed upon the one upon which they then stood. There the Company had ample room for extension, having nearly 7½ acres at their disposal, which he thought it would be admitted would give great facility for everything they would require for years to come. It had always been, and always would be, he trusted, the desire of the Directors to sell gas at the smallest possible price compatible with the interests of the Shareholders. Having spoken of the favourable position of the site with regard to railway accommodation, &c., he referred to the absence of accidents in the old works during the many years the Company had been serving the town, and expressed a hope that Providence would grant in the future the same safety to all concerned as in the past. He remarked that the existence of gas-works in the midst of a population was not unhealthy, because it had been reported to them that the district of their works was one of the most healthy in Tunbridge Wells.

The ceremony of laying the stone was then proceeded with. The stone bore the following inscription:—"This stone was laid by E. M. Hunter, Esq., Chairman of the Tunbridge Wells Gas Company, April 25, 1878."

The Rev. Canon HOARE, having offered prayer, addressed the assembled workmen. After referring to many happy gatherings they had had in the old works, he expressed a hope that the same spirit would continue in the new as in the old works; adding, that as the Directors and his friend Mr. Scott, the Manager, had arranged so well for the honour of God in the old works, so he firmly believed they would continue to do it in the new, because of the blessing they believed would rest upon it.

Mr. SIMPSON thanked Canon Hoare for attending on the occasion. They had great reason to be thankful to the reverend gentleman, knowing as they did how ready he always was to answer the calls made upon him, however great the inconvenience might be to him. The address which he had delivered to the working men was equally applicable to all present, and he hoped every one would learn much, and be benefited by it.

Mr. W. DELVES, as the oldest member of the Board of Directors, proposed thanks to their Chairman, Mr. Hunter, for the admirable way in which he had conducted the proceedings of the day, adding that they were still more indebted to him for the admirable way in which he had conducted the business of the Company for the past 30 years as their Chairman, their prosperity having been due to the care, time, and ability he had devoted to the business of the Company. He hoped Mr. Hunter would live many years to preside over the Company, and see the new works, now in progress, completed and prosperous.

Mr. HUNTER having acknowledged the compliment, an adjournment for luncheon took place.

"Success to the Tunbridge Wells Gas Company" was heartily drunk, on the proposal of Mr. Hunter, the Chairman, as well as the health of the Engineer, Mr. Spice. The latter gentleman replied at some length, after which a survey of the works was made, and the proceedings terminated.

In the evening a dinner was given to the workmen of the Company.

A NEW METHOD OF PRODUCING CHEAP HEATING GAS FOR DOMESTIC AND MANUFACTURING PURPOSES.

On Wednesday, April 10, at the Ordinary Meeting of the Society of Arts, Mr. S. W. DAVIES, A.R.S.M., read the following paper:—

It will be within the memory of many members of this Society that, in the year 1872, a sum of money was placed at the disposal of the Council of the Society of Arts, for promoting, by prizes or otherwise, economy in the use of fuel for domestic purposes.

A Committee was formed, to whom was entrusted the task of deciding on the best means for carrying into effect the wishes of the donor. A number of prizes and medals were offered for the best and most economical apparatus for cooking and heating, both by coal and gas. After a careful investigation of the claims of a large number of exhibitors, who forwarded their apparatus for trial in buildings specially erected for the purpose at South Kensington, the Committee decided that no prize could be awarded. But, although it was found that inventors had made little advance in the direction of economy of fuel worthy of the name, no doubt minds were set to work to try and fulfil the conditions under which the prizes had been offered. Among the various inventions which made their appearance after the conclusion of the Society of Arts experiments, was one by Mr. Joshua Kidd, the principle of which was that the gases from ignited coal were mixed with the hydrogen from decomposed water.

The complete gasification of the fuel used was a remarkable feature of the process, and it was this fact which led some gentlemen interested in the subject to adopt the idea, and to purchase Mr. Kidd's patent. Two years of patient trial, analysis, and experiment have enabled them to alter and adapt the principle contained in the original invention. Difficulties of all sorts have been overcome, and, although they are still on the way to improvement of the gas and its application in many directions, both for heating and lighting, they consider that, in its present state, it is of too great public importance, where a cheap heating gas is required, to delay any longer making its manufacture and application as widely known as possible.

Numerous attempts have been made by previous workers in this direction to produce a cheap gas for heating purposes, by the action of water vapour on incandescent carbon.

It has long been known that if steam be passed over coke or charcoal heated to redness, a decomposition of the steam takes place, hydrogen (H), carbonic oxide (CO), carbonic anhydride (CO_2), and a small proportion of marsh gas (CH_4) being produced.

The composition per cent. by volume of the mixed gas produced in this way is, according to Langlois' analysis—

$$H = 54{\cdot}52 \quad CO = 31{\cdot}86 \quad CO_2 = 12 \quad CH_4 = 1{\cdot}62;$$

according to Frankland's—

$$H = 56{\cdot}9 \quad CO = 29{\cdot}3 \quad CO_2 = 13{\cdot}8.$$

It is evident, therefore, from these analyses, that we have here a very important heating gas, could we succeed in producing it in considerable quantities economically. How to do this most effectually has formed the subject-matter of numerous patents. It is not my intention to enter into a discussion on the relative merits and demerits of the various processes proposed in these patents, any such course, indeed, being rendered unnecessary by the fact that very few of them have been commercially a success. The cause of this want of success is not, I think, far to seek; the apparatus devised for carrying out the processes being for the most part large and costly, and rarely complete in itself, or what one may term self-contained—that is to say, in addition to the actual retort or generator in which the gas is produced, a special boiler and superheater are required for generating and superheating the steam used in the process, and in most cases the retort or regenerator requires to be set in a furnace and heated by a special fire, in the same way as an ordinary gas-retort. Or, if this course be not adopted, and only one fire used, viz.—that in the generator itself, then a special blowing apparatus becomes necessary, and the production of gas is intermittent instead of continuous, for steam and air have to be urged in succession through the same column of fuel, and it is only when the steam-jet is in action that gas is produced, the air blast being employed to blow up and revive the fire, the temperature of which is much reduced by the passage and decomposition of the steam.

I think it must be abundantly clear that these extra pieces of machinery and additional processes add very materially to the cost of erecting and working the apparatus, and also to the price of the gas produced, which, taken in connection with the large space occupied by the complete apparatus, entirely prevents it from coming into general use for small manufacturing and domestic purposes, thus shutting it out from what I conceive to be one of its widest and most important applications.

The apparatus I am about to describe and explain does not, it will be seen, labour under any of the disadvantages enumerated above; it is small, compact, by no means costly, and combines a gas generator, boiler, and superheater in one; it generates its own blast, is continuous in its action, and so easily worked that a person of average intelligence may be taught to attend to it in a few hours.

The generator consists of a hollow cylindrical body or case, made for convenience, at present, of wrought or cast iron, but which ultimately may be constructed of other materials. This cylinder is terminated below by a cast-iron bottom, having a hole in its centre about one-half or one-third its own diameter. Below this again, and forming part of the bottom casting, is a second hollow cylinder of the same internal diameter as the hole above it. In this lower cylinder the fire-grate is lodged; the blast-pipe opening into it below the fire-grate. The grate fits the cylinder loosely, and is attached to it on one side by means of a hinge, the other side being supported, when in position, by a pin screwed through the cylinder; this arrangement permits the grate to be readily moved up and down, and facilitates the withdrawal of the charge when necessary.

When making gas, the bottom of the small cylinder requires to be closed air-tight. This is effected either by means of a flat hinged plate, which is kept tightly pressed against it by a heavily weighted lever, or else by a short cap with a bevelled edge attached to it by a bayonet joint. In the upper and larger cylinder there is a coil of thick wrought-iron pipe, which fits the cylinder pretty closely, and is attached to it by means of a series of brackets or supports, which prevent the coil from collapsing by its own weight. At the bottom, the coil is protected from the intense heat of the fire by a thin lining of gannister. The two ends of the coil are turned outwards at right angles, and pass gas-tight through the body of the generator. The lower end is connected with an arrangement for supplying water under pressure, and the upper end with a steam-pipe of smaller diameter, which passes down parallel to the generator, and terminates in a small steam tap immediately in front of the blast-pipe.

The top of the apparatus is a casting of rather peculiar shape. In its centre there is a circular opening about nine inches in diameter, communicating below with a hollow inverted truncated cone projecting into the interior of the generator. At the apex of the cone there is a narrow cylindrical ring, which serves as the seat for a heavy conical valve, which fits it gas-tight. Above, this is surmounted by a short cylindrical fuel-box, carrying at its upper end a hopper, the opening between being covered by an ordinary flat sliding plate or valve. Attached to the fuel-box there is a short flue, used when lighting the fire, but closed when making gas. In addition to the central opening in the cover of the apparatus, there are two smaller ones; the larger of these being the gas outlet, and the smaller a peep or stoke-hole; this is closed, when not in use, by a gas-tight cap or plug. The whole apparatus is supported on three legs, attached to the flat underside of the bottom casting.

Presuming I have succeeded in making the construction of the gas-producer intelligible, it will, I think, be readily seen that, if a fire be lighted in the interior, and water driven through the coil, that water will be rapidly caused to boil, steam will be produced, which will accumulate in the upper part of the coil, and, if not immediately allowed to escape, will take up a further increment of heat, and pass into the condition of superheated steam. If now the tap in front of the blast-pipe be opened, this superheated steam will pass down the small pipe outside the generator, and blow with considerable force into the blast-pipe, carrying with it, by its inductive action, a stream of air. By properly apportioning the size of the steam-jet to the internal diameter of the coil, a constant supply of superheated steam is obtained, and, as a matter of course, a continuous blast of air ensured. In this way, then, the requisite oxygen to support combustion, and steam for decomposition, are driven into the apparatus with considerable force, from which, after traversing the column of heated fuel, they issue as a permanent gas.

Before, however, tracing the mixture in its upward course through the fire, it will, perhaps, be as well to describe the mode of working the apparatus, in order that you may see how very simple the operation really is. For this purpose, I will assume that the generator is empty.

Before lighting the fire, I shut the valve in the gas-main, open that at the bottom of the ash-box, lift the conical valve off its seat by means of the lever handle outside the fuel-box, close the steam-tap, and open the water-cock, so that I start, in fact, with the coil full of water, and the interior of the generator in free communication with the chimney. The fire is lighted in the ordinary way, the necessary wood, coal, &c., being charged in through the hopper; a light is applied to it from below the fire-grate, and the chimney draught draws up the fire in the same way as in a common closed stove. When the fire burns briskly up, as it generally does in about a quarter of an hour after lighting, unless it be fed too fast or otherwise checked, superheated steam will be abundantly produced. The steam tap may now be slightly opened, the valve at the bottom of the ash-box closed, and the fire more rapidly blown up by the steam blast, the jet being gradually opened as the intensity and body of the fire increases, until the full blast is given. In charging the apparatus with fuel, it is advisable not to use large lumps, nor, especially at first, to feed it too fast, otherwise an injurious lowering of the temperature in the upper part of the generator is likely to take place, and wet instead of superheated steam comes over. By a judicious use of the peep-hole this may entirely be prevented, as new fuel should only be added when the upper part of that already in the generator begins to appear red hot. The charge of fuel is put in the hopper, and the sliding plate withdrawn; this allows the fuel to fall into the cylindrical box beneath, and if the conical valve be up it passes direct to the generator; if, on the other hand, this valve be down, as is always the case when making gas for use, it falls upon and around the valve, and remains in the fuel-box till this valve be lifted, which, of course, should not be done before replacing the sliding plate between the hopper and the fuel-box. This mode of charging prevents any escape of gas into the room, and admits of the apparatus being fed as often as may be necessary while making gas.

When the generator becomes about one-third to one-half full of fuel, good gas will be abundantly produced, which may be turned at once into the gas-main. To do this, it is only necessary to drop the conical valve on its seat, and open the gas outlet, when, the communication with the chimney being cut off, the gas passes directly to the pipes and apparatus connected therewith.

The water is supplied to the coil under pressure. The necessary pressure may easily be obtained in either of two ways—viz., by a cistern placed at a sufficient height above the generator, or by a small accumulator standing alongside it, and provided with a hand force-pump and gauge. The latter plan is much to be preferred, as it enables the pressure to be altered at will, and brings the whole process well under control. For this purpose only a very small accumulator is necessary, and the amount of extra work thus thrown on the attendant is almost nominal. For instance, I have worked a generator producing about 4000 cubic feet of gas per hour with an accumulator only 2 feet high by 9 inches in diameter, and I found, even with so high a pressure as 60 lbs. on the square inch, a few strokes of the pump every quarter of an hour or so was all that was required to keep up the pressure and supply the coil with water. The accumulator we employ consists simply of a hollow cylindrical vessel provided with a force-pump and gauge, and containing air, by the compression of which any desired pressure may be obtained, from 1 lb. or 2 lbs. to 100 lbs. on the square inch; it acts, therefore, on exactly the same principle as the air-vessel of a pumping-engine.

Here I would call your attention to the absolute safety of this method of working, and to the impossibility of bursting the coil, even should a stoppage occur in it. The only thing that could happen in such a case as this is, that the water and steam in the lower part of the coil would, when the pressure rose high enough, be driven back into the accumulator, where the steam would be instantly condensed in the cold water, which it would barely warm, as the quantity of steam in the coil, compared with the quantity of water in the accumulator is extremely small. This arrangement, therefore, acts as a most perfect safety-valve, and prevents the steam pressure from ever rising sensibly above the ordinary working pressure.

Now, as we have seen, the air blast is set up and maintained by the inductive action of the jet of superheated steam playing into a small tube or blast-pipe, which opens into the cylindrical ash-box beneath the fire-grate. The intensity of this blast, therefore, will manifestly depend upon the water pressure in the accumulator; and as the force with which the gas issues from the generator will clearly be proportional to the strength of the blast, the whole admits of easy adjustment, to meet the varying conditions of pressure and resistance which the gas may have to overcome. With respect to the actual gas pressure obtainable in this way, I found experimentally that, with a water pressure in the accumulator of 15 lbs. on the square inch, I obtained a gas pressure in the generator of over 1 inch of water, and with a water pressure of 40 lbs. on the square inch, the corresponding gas pressure in the generator was 2½ inches of water. This latter is considered to be a good average working pressure.

The fire-bars are kept cool by the steam and air pressing betweetn hem, and are thus prevented from rapidly burning or oxidizing away.

The chemical reactions which occur in the generator I take to be very simple. Carbonic anhydride (CO_2) is doubtless first formed by the action of the oxygen of the air upon the carbon of the fuel; this, in its passage upward through the heated fuel, takes up another equivalent of carbon, becoming reduced to carbonic oxide (CO) thus; $CO_2 + C = 2CO$, the nitrogen, of course, passing off unchanged, and serving only to dilute the gas. With respect to the steam, this, as explained above, is decomposed in its passage over the incandescent coal, with the formation of hydrogen, carbon-monoxide, and carbonic anhydride; the latter in its upward course sharing the same fate as the CO_2 produced by the action of the oxygen of the air,—*i.e.*, it takes up another atom of C, and passes into the state of CO. The decomposition, therefore, of the steam adds materially to the calorific value of the gas, by enriching it with hydrogen and a further quantity of CO.

The composition of the gas produced by this generator, when working at different pressures of water, and with various kinds of fuel, has been determined by analysis. The result is as follows:—

Description of Fuel.	Pressure of Water per Square Inch.	Composition per Cent. by Volume of the Gas.	
Peat charcoal	15 lbs.	CO	28·6
		H	14·6
		CO_2	4·0
		N	53·0
			100·2
Anthracite	15 lbs.	CO	22·6
		H	10·0
		CH_4	4·9
		CO_2	4·5
		N	58·0
			100·0
Equal parts of anthracite and steam coal	30 lbs.	CO	28·3
		H	9·3
		CH_4	5·2
		CO_2	6·2
		N	51·3
			100·3
Anthracite	60 lbs.	CO	26·4
		H	13·5
		CH_4	1·4
		CO_2	3·9
		N	54·8
			100·0

As regards the quantity of mixed gases produced from a given quantity of fuel, this has been ascertained experimentally in the most careful manner, every precaution being taken to eliminate all sources of error. The gas from the generator was first passed through about 100 feet of 3-inch pipe, more than 50 feet of which was out in the open air, and then through a large meter.

Before reaching the meter, therefore, the temperature of the gas had been reduced to about 60° or 70° Fahr.

The following are the results:—

Description of Fuel.	Water Pressure in Pounds per Sq. Inch.	Cubic Feet of Gas per Pound of Fuel.
1. Anthracite	15	69·5
2. Equal parts of anthracite and steam coal	20	85·2
3. Equal parts of anthracite and steam coal	25	88·84
4. Equal parts of anthracite and steam coal	30	94·5
5. Anthracite	40	(over) 100·0

It will be seen, therefore, that there is a steady increase in the quantity of gas produced per pound of fuel consumed, as the water pressure rises from 15 lbs. to 40 lbs. Beyond this point there does not appear to be much advantage gained by still further increasing the pressure; at least, this is the case in the smaller size generators, with which hitherto most of the experiments have been made. I confess it is somewhat difficult to account for the increased yield of gas at the higher pressures, as, of course, no one pretends to be able to obtain more than a certain definite quantity of carbonic oxide and carbonic anhydride by the oxidation of a given quantity of carbon. I think, however, it may be due in part to two causes. At the higher water pressures the force of the steam jet is proportionally increased; consequently, a larger volume of steam and air is injected into the apparatus in a given time. This gives rise to more intense combustion

of the fuel, which is, I believe, at the same time, more perfect combustion, and it is to this cause, and the fact that a larger volume of steam is simultaneously decomposed, that we must attribute the increased yield of gas.

After making numerous trials of different kinds of fuel, the conclusion arrived at is, that although a variety of non-caking fuels, such as coke, wood charcoal, peat charcoal, steam coal, &c., may be used, yet, on the whole, anthracite coal gives the best results, and is much to be preferred for use with the apparatus.

It might be thought that tying it down in this way to the use of one particular class of fuel, would very much tend to restrict the use of the apparatus, and practically shut it out from competition for steam-boiler purposes, especially on board ship. I do not, however, think this will prove to be the case. We have vast stores of anthracite coal, both in Wales and Ireland, at present almost unworked, and waiting to be developed; only a very small quantity being now raised for copper smelting, and a few minor purposes. So also in British Columbia, Vancouver's Island, and many other of our insular possessions, there are great quantities of this fuel lying practically useless, because as yet no practicable method of burning it economically in our ordinary furnaces has been discovered; indeed, it has been stated that at some of these places we have been obliged to establish coaling stations, and carry to them ordinary bituminous coal for the use of our steam ships, because our boiler furnaces are not adapted to burn the fuel already on the ground.

The use of what has been termed anthracite coke in marine boilers was advocated in a paper read last summer before the United Service Institution, by Captain Geary, R.A., in which he states that, by the use of this kind of fuel, burnt under blast in a specially constructed furnace, quite separate and distinct from the ordinary boiler furnace, or in what is practically a gas generator somewhat resembling the one I have described, he got a result which was superior as regards fuel consumed, and the speed of producing a certain effect, to a similar boiler fired in the ordinary way, in the proportion of 6·8 to 1.

In the discussion which followed the reading of this paper, the desirability of devising some means of utilizing anthracite for steam navigation purposes was insisted on by nearly every speaker, and the subject still excites considerable attention among naval architects and engineers.

I venture, therefore, to think that this apparatus is a step in the right direction.

Of all the proposed methods for generating a cheap heating gas, either for domestic or manufacturing purposes, the only one, so far as I know, that has hitherto met with much success, is the process patented by Siemens. This is now extensively used in the manufacture of iron, steel, glass, &c., both in this and other countries. It will, perhaps, be worth while, therefore, to institute a comparison between the quantity and quality of the gas produced by this process and the one I am describing.

In Percy's "Metallurgy," Vol. I., p. 528, the composition per cent. by volume of the gas produced by a set of Siemens's generators in work at St. Gobain, France, is set down as—

Hydrogen	4 to 11	per cent.
Carbonic oxide	15 „ 19	„
Carbonic acid	6 „ 7	„
Nitrogen	75 „ 63	„

The first two of these constituents, or from 19 to 30 per cent., are alone of any use as fuel.

Turning now to the analysis of our gas given above, I find that the inflammable constituents stand in the proportion of from 37·5 to 43·2 per cent. The gas produced by this method, therefore, is much richer in heat-producing material than the gas produced by Siemens's method, and, of course, its calorific value is proportionally increased.

With regard to the respective quantities of gas produced by a given consumption of fuel in the two processes, I find Dr. Percy estimates that one ton of coal, exclusive of earthy matter or ash, is capable, when treated in the Siemens generator, of producing about 50,000 cubic feet of gas at 15° C.

The records of the experiments made with this apparatus, and of which I gave a brief epitome above, show that one ton of fuel treated in it yields from 155,680 to 224,000 cubic feet of gas; that is, from 3 to 4½ times the quantity yielded by the Siemens process. This gas, therefore, is both richer in quality, and produced in much larger quantity than Siemens—a fact which, if it stood alone, ought to be sufficient to prove the great practical value of the invention.

There is, however, one other point to which I would for a moment direct attention. Siemens's generators are large and costly, and the space occupied by the complete apparatus is very considerable; they are, therefore, only applicable to large manufacturing and metallurgical processes, such as those enumerated above, and are in nowise adapted for making gas for smaller works or private establishments.

On the other hand, these generators can be made almost of any size, either small or large, so that they are eminently adapted for use in small manufactories, such as chemical works, potteries, foundries, forges, drying processes, &c., where cleanliness, economy of fuel, absence of smoke, and simple regulation of temperature are required. Further, it is believed that the comparatively small cost of the apparatus, and the ease and facility with which it is put into operation, render it peculiarly fitted for making gas for domestic purposes. The use of gas as fuel is beginning now to be more generally understood and appreciated, and it is pretty readily admitted that, for cooking purposes at least, it is nearly as economical to employ gas as coal, with the advantage that it is much cleaner—there is no dirt, dust, or soot—and the saving in labour alone is very great. In addition, it has been clearly shown that the waste of meat when cooked by gas is from 10 to 15 per cent. less than when cooked in the ordinary way. At the London Hospital it has been estimated that a saving of £400 a year has been effected by substituting cooking by gas for cooking by coal; and a large employer of labour, on whose premises the cooking is done daily for about 1200 people, states that he is saving something like £800 a year in a similar way.

Of course, at both these establishments ordinary street-lighting gas is the fuel employed, and the burner used is that invented by Bunsen, and generally known by his name. The peculiarity of this burner consists in mixing air with the gas before it is consumed. Under these circumstances the gas burns with a blue, lightless flame, and there is no deposition of soot or carbonaceous matter; the gas is, in fact, perfectly burnt, the sole products of combustion being water and carbonic anhydride, or, as it is more generally termed, carbonic acid.

The gas produced by these generators is essentially a non-luminous gas. When taken direct from the producer, it burns with a reddish-blue flame. After having, however, been stored in a gasholder for a few hours in contact with water, the flame loses this red tinge, and the gas burns with a blue lightless flame very much resembling ordinary gas burnt in the Bunsen burner. In neither case is there any smoke, soot, or deposit of any kind by the burning gas, the sole products of combustion being water and carbonic anhydride. It is unnecessary, therefore, to mix air with this gas before it is burnt, as there is no luminosity to be destroyed, or deposition of carbonaceous matter to be prevented.

On the table there are two gas-burners; one is a Bunsen burner of the ordinary construction, connected by a piece of tubing with the street gas supply; the other is simply a bent tube, somewhat resembling the Bunsen in shape, but having no holes at its base for the admission of air. This burner I will connect by a piece of flexible tube with a small holder in which a quantity of the heating gas has been stored for some hours. Both burners are now in action, and you see there is a marked resemblance between the two flames.

Of course, notwithstanding this similarity, there is a considerable difference in the calorific power of the two gases. Very careful trials show that it requires about five times the bulk of this gas, as of ordinary lighting gas, to heat a given quantity of water through a certain number of degrees.

But this comparison only holds good when the two gases are burned in the open air. The ordinary ring burner, which appears to be tolerably well adapted for use with common lighting gas, is not in any way an advantageous form of burner for our heating gas; but as the manufacture of special means is always an incumbrance to the application of any novelty, I think I am best recommending its use by showing you what our gas can do with the ordinary appliances in use.

We have ample evidence, in every direction experimented on, that the greatest development of heating power is obtained when the gas is burned in what may be called "partial confinement," or with the jets so enclosed that the air entering to support combustion is capable of being easily and accurately adjusted. As, however, this point remains to be more fully worked out, we will not take it at all into account in forming an estimate of the comparative cost of doing a given amount of work by the two kinds of gas, but will assume, as the basis of our calculations, that one cubic foot of coal gas is equivalent in heat-giving power to 5 cubic feet of the heating gas.

A No. 1 generator will produce on an average 1000 cubic feet of gas per hour, and consume about 10 lbs. of coal; taking a working day of ten hours, the consumption of coal will be about 1 cwt., and the gas produced 10,000 cubic feet.

The cost of the 10,000 cubic feet of gas will be as follows:—

1 cwt. of anthracite	1s. 1d.
Wages of attendant	4 0
Ordinary coal and wood used in lighting the fire	0 2
Total	5s. 3d.

The cost of the 2000 feet of lighting gas required to do an equivalent amount of work is from 7s. to 8s.

With the larger size generators the saving is still more marked. A No. 2 generator consumes about 35 lbs. of coal an hour, and produces 3500 cubic feet of gas an hour. The cost of the 35,000 cubic feet of gas produced in a working day of ten hours is as follows:—

3½ cwt. of anthracite	3s. 6d.
Wages of attendant	4 0
Ordinary coal and wood used in lighting the fire	0 4
Total	7s. 10d.

In heating power, this would be equal to 7000 cubic feet of ordinary London gas, costing from 24s. 6d. to 28s. It is, therefore, manifest that where the consumption of gas is considerable, a most important saving is effected by using the larger size apparatus.

I think, however, it is only fair to say that when working the No. 1 generator the attendant's time is by no means fully occupied; indeed, in some experiments I made with the apparatus, lasting over several weeks, one man attended to three of them with the greatest ease.

The cost of the application of this gas for large establishments will depend on the rate, and the varying quantity of the consumption; if this be constant and continuous, it is not absolutely necessary to introduce even a pressure regulator between the generator and supply-pipes, as the gas can be carried direct to the cooking and heating apparatus, and there consumed. The only advantage gained in such a case as this, by the use of a governor, is that the pressure in the main is kept constant while charging the generator with fuel.

If, however, the gas cannot be usefully consumed as fast as it is generated, then it becomes necessary to employ a holder, and to store the gas in the ordinary way. For this purpose any common gasholder may be used, no specially constructed holder being required.

The gas can be sent direct from the generator to the holder, without passing it through a scrubber or other apparatus for washing or cleaning it, as there are no tarry or ammoniacal products to be condensed or removed. Also the pressure under which it is produced is sufficient to overcome a resistance measured by a column of water 2 inches in height, and this, in a common gasholder, is amply sufficient for most purposes. No adjustment of the weights, therefore, every time the holder is filled, becomes necessary.

At the works in Battersea the gasholder is generally kept weighted, so as to give a pressure in the mains of about 1½ inch to 2 inches of water. Not the slightest difficulty is experienced in working the apparatus against this amount of resistance, with a water pressure in the accumulator of 40 lbs. on the square inch.

I have often been asked whether this gas does not become deteriorated by being stored in contact with water. Some people seem to labour under the misapprehension that, because it is produced in part by the decomposition of water vapour, there is a corresponding tendency towards condensation; they appear to forget that the constituents of the water have been separated by the action of the incandescent fuel, and transformed from a readily condensable, completely—or at least permanently—oxidized gas or vapour, into two gases, which at ordinary temperatures and pressures are non-condensable, but slightly soluble in water, and only one of which is partly oxidized.

To prove, however, that the gas suffers no material change in composition by being stored in contact with water, an analysis was made of a sample that had been kept in the gasholder for more than a week. This gas contained in 100 parts as follows:—

Carbonic oxide	CO	=	24·3
Hydrogen	H	=	15·5
Carbonic anhydride	CO_2	=	3·4
Nitrogen	N	=	56·8
Total			100·0

On comparing this analysis with those of the unstored gas given above, it is manifest that no bad effect is produced on the gas by storage, and that it may be kept for any reasonable time in a holder without deterioration. This, therefore, disposes of the question of the storage of the gas in holders, &c.

I mentioned, however, just now, that in large establishments—such as clubs, hotels, hospitals, barracks, unions, prisons, &c.—in which the consumption of gas for cooking and heating purposes would of necessity be large, no holder is required, as the gas can be used direct from the generator. This has been practically demonstrated in the most complete manner at the works of Messrs. Leoni, where a long series of trials were carried out with the apparatus, and in every case the gas was passed direct from the generator into the 4-inch main, with which the various cooking and heating stoves to be experimented on directly communicated. No pres-

sure regulator or governor of any kind was employed in these experiments, neither was there any alteration made in the apparatus to adapt it to the use of this gas, except the stopping up of the air-holes in the atmospheric burners.

In one trial two large ovens, each 5 feet high, by 2 feet 3 inches wide, by 2 feet 6 inches deep, a boiler holding 35 gallons of water, and a large steamer, were joined up to the 4-inch main. At first the whole of the gas produced was turned into the ovens and boiler. In 75 minutes after lighting the gas, the ovens reached a temperature of 400° Fahr., and in 15 minutes more the water in the boiler was at the boiling point. The gas under the boiler was then nearly turned off, that in the ovens being slightly lowered, and the steamer got to work. In 30 minutes after lighting there was an abundance of steam for cooking purposes. This steamer is calculated to cook 1 cwt. of potatoes in about 30 minutes. All this time the ovens were kept at a temperature of 400° Fahr.

The actual quantity of ordinary gas required to work the ovens and boiler, or ovens and steamer, is from 280 to 320 cubic feet an hour. Estimating the quantity of gas produced by the generator at 1200 cubic feet an hour (which is its outside rate of production), it will be seen that the comparative heating effect of the gas, as determined by these trials, is considerably higher than that assumed when making the calculations given above. Since this trial was made, Messrs. Leoni have tested the apparatus in all sorts of ways, and in every case with pretty much the same result. Not the slightest difficulty has every been experienced in using the freshly prepared gas direct from the producer, without the intervention of a gasholder or pressure regulator of any kind. This is justly looked upon as a very important point, especially as regards the application of the gas in large towns, where gasholders would be often inadmissible, and the introduction of pressure regulators even might in some cases be attended by considerable inconvenience. We are now, however, in a position to state positively that such adjuncts can, in the case of large establishments, be entirely dispensed with, and that the gas may, for cooking and heating purposes, be directly applied.

Experiments of a somewhat similar kind to those detailed above were made on soldiers cooking apparatus at Wellington Barracks. As, however, the results were in both cases almost identical, it will be unnecessary for me to enter into a long description of them. I will, therefore, confine myself to one experiment. In one of the cook-houses there is a large Dean's roasting and baking oven—internal measurement, 4 feet × 2 feet × 2 feet = 16 cubic feet contents. To this oven it was decided to apply the gas. For this purpose it became necessary to devise a special burner, as the oven is arranged for burning solid fuel. The burner employed was made in the form of a cross, each arm having in its upper side a circular opening 2 inches in diameter for the exit of the gas. This was placed in the fireplace, and connected with the generator by a 3-inch main, and the whole of the gas produced by a No. 1 generator burned in it. The flame from the burning gas did not impinge directly on the flat iron bottom of the oven, but upon the invert of a flat arch of fire-brick, 4 inches thick, closely applied to it, and forming the crown of the furnace. This arch and brick lining of the fireplace were raised to a bright red heat in about 45 minutes after lighting the gas. The temperatures attained by the oven were as follows:—

30 minutes after lighting, temperature				235° Fahr.
45	"	"	"	336° "
60	"	"	"	450° "
75	"	"	"	523° "

Before making this trial, the oven had been lying neglected for some months, as it was considered by the cooks to be a particularly badly constructed one, in which, on account of the sluggish draught, they were unable to either bake or roast properly. They were not, it is true, very sanguine of our being able to do with gas what they had failed to do with solid fuel, and were at first rather inclined to shake their heads and smile incredulously. The result, therefore, took them completely by surprise. They have a rough-and-ready method of ascertaining approximately the temperature of the interior of their ovens by touching the iron nobs on the doors. Just before the close of the trial they came one after the other and applied this test—which to them was a much more satisfactory one than the indications of a thermometer—and they declared that if they had fired the oven in the ordinary way for a whole day it would not have been so hot. Even with the best constructed ovens, it takes them from two to two and a half hours to get up the same heat that we reached in a little over an hour, and that, too, with a much greater consumption of fuel. Thus, the No. 1 generator used in this trial consumes from 10 to 12 lbs. of coal an hour. Their furnaces, as near as one could ascertain, burn from 15 to 18 lbs. of coal an hour; consequently, we did with from 12 to 15 lbs. of coal in 75 minutes what it takes them 120 to 130 minutes to do with from 30 to 40 lbs. of coal.

The most eminent metallurgists and engineers have long maintained that the most perfect kind of fuel, for either manufacturing or engineering purposes, is gas. It will be quite useless, therefore, for me to stop to insist upon this point, or do more than just indicate some of the advantages that have been claimed for this kind of fuel. Briefly, these are as follows:—

1. Saving of fuel, less being required to do a given amount of work.
2. Increase of work done in a furnace of given dimensions, being the result of the great calorific power at command.
3. Complete command over the heat of the furnace.
4. Perfect uniformity of heat throughout the furnace, and greater durability of brickwork, owing to the absence of ashes, by which the fusibility of the surfaces with which they come in contact is much increased.
5. The production of a flame of such purity as to diminish materially the waste by oxidation and deterioration of the metals, &c., operated on.
6. Increased command of the heat employed, and of the chemical effects produced by the flame, which can be immediately checked when required, or at once changed from an oxidizing to a reducing one, or *vice versâ*.
7. Great cleanliness.
8. Absence of smoke and soot, which, in the neighbourhood of large towns, is of great importance.

These admirable qualities have led to the adoption of this kind of fuel in a number of works, and for a variety of purposes. The great bar that has hitherto prevented it from being much more extensively used is, as before mentioned, the cost and size of the generator and its appendages. It is, however, believed that now simple means have been discovered of producing a richer heating gas than that hitherto employed, and in any quantity at pleasure, either large or small, to suit the special purposes for which it is required, that its well-known and manifold advantages will ultimately result in its being almost universally adopted in small as well as large works, to the exclusion of the grosser forms of fuel; and that it is only necessary to make the existence of this apparatus more widely known to ensure a steady and increasing demand for it.

A series of experiments have been made, with the view of showing the applicability of this gas to the heating of furnaces for metallurgical and other processes. Of course, no experiments were needed to prove that in a properly constructed furnace a very high temperature could be obtained by the use of gaseous fuel, as that point has long been set at rest by Siemens and others. But it was necessary to show to intended consumers that our gas could be utilized in this way, and that in a furnace of corresponding dimensions, as high a temperature could be attained by the consumption of the gas produced by this small generator—burning on an average 10 lbs. of fuel an hour—as by a large apparatus consuming from 2 to 3 tons of coal a day, and that, too, if possible, without the use of those large brick regenerative chambers, which are so costly an adjunct to the larger apparatus.

With this view we had constructed a small furnace, to which was applied the gas from a No. 1 generator. I shall not trouble you with the details of this furnace, as it was so obviously defective in many respects that to describe it in its present form would be useless. Suffice it to say, notwithstanding these defects, by means of an extremely simple accumulating and reversing arrangement, a temperature of from 2000° to 3000° Fahr. was readily attained in it, and cast iron melted in a few minutes.

This result is so far satisfactory, but it falls very far short of what can, and will be, attained with an improved construction of furnace. On this point, however, further experiments are much needed, in order to put this very important matter beyond the possibility of a doubt; but such experiments, I need hardly point out, require time and means.

As regards the application of the gas for steam-boiler purposes, comparatively few experiments have been made, and those only of a very rough description; the results, however tend to show that, with better modes of applying the gas, and with the experience gained in those trials to guide us, very much better things may be expected from any future trials.

In some experiments made at Woolwich Arsenal on a small boiler in the chemical laboratory, we succeeded in getting a considerably greater evaporative effect, per pound of fuel consumed, than was obtained when the same boiler was stoked in the ordinary way.

Of course, in making such experiments as these, it has always to be borne in mind that the apparatus under trial must be adapted to the boiler, and not the boiler to the apparatus. This is the principle on which the experiments at the Arsenal were conducted, and I must confess my opinion now is that, in tying ourselves down too rigidly to this rule, we committed a grave error. For it is obvious that it is next to impossible to obtain anything like the full calorific power of gaseous fuel by attempting to burn it almost without preparation of any kind in the large ill-constructed furnaces in which so much solid fuel is now wasted in our boilers.

However, as I said just now, we gained valuable experience from those trials, and the result was far from being an unsatisfactory one, notwithstanding the crude way in which the gas was applied.

If, in future, we should be in a position to undertake fresh experiments in this direction, and a judicious combination of the experience thus gained be effected with another well-known experimental fact, viz., that in a combustion chamber, if the walls be persistently kept far below the temperature at which combination of oxygen and hydrogen, or oxygen and carbon, takes place, the resulting combustion must of necessity be imperfect. I have no doubt a far different result will be obtained, and the immense superiority of gaseous over solid fuel, for boiler purposes, be most completely demonstrated.

Respecting the use of the gas for illuminating purposes, I have not much to add. We have seen that, as it comes from the producer, it is essentially a non-luminous gas. Attempts have been made, during the process of manufacture, to convert it into a permanent illuminating gas, by throwing into it the necessary proportion of carbon; as yet, however, these attempts have only been partially successful.

Of course, the gas can be carburetted in the same way as common air, by passing it through a peculiarly constructed vessel termed a carburetter, containing the highly volatile distillate from petroleum known as gasoline. Under these circumstances, it takes up a quantity of the hydrocarbon vapour, and becomes transformed into a luminous gas of considerable power. With the special burner recommended for use with this gas, as high an illuminating power as 19 parliamentary sperm candles has been obtained, and an average light of from 15 to 16 candles, with a consumption of about 5 cubic feet of the carburetted gas per hour. I have here a small carburetter containing gasoline, and connected with it is one of the special Argand burners. I will pass some of the gas from this holder through the vessel, and show you the flame of the carburetted gas; and in order that you may form a better estimate of the change effected in the gas by this process, I will again light the simple bent tube burner we employed just now. This, as you see, is connected with the gasholder direct, and not with the carburetter. Both burners are now in action, and you can judge of the effect produced on the gas by mixing with it the vapour of the volatile hydrocarbon.

It will, perhaps, be as well to state here, that this carburetting process forms no essential part of the principle of the apparatus I have described; it is only looked upon as a useful adjunct in places where coal gas cannot be readily obtained, and it is not intended for one moment to compete with the latter for illuminating purposes.

When it is intended to carburet the gas, and to employ it as a source of light as well as heat, it becomes absolutely necessary to use a gasholder, both to store the excess of gas made by the generator, and also to equalize the pressure, which in the generator itself is liable to slight fluctuations, of no consequence whatever when the gas is simply used as a source of heat, but highly objectionable when it is employed for lighting also.

In reply to a question by Mr. Hale,

Mr. DAVIES said that the cost of the gas was about 5s. 3d. for 10,000 cubic feet in a small generator, but when a large generator was used, the cost was 7s. 10d. for 35,000 cubic feet, or about 3d. per 1000. This was equivalent in heating power to 7000 cubic feet of ordinary London gas, costing from 24s. 6d. to 28s. It was not supposed that the apparatus could be introduced into every small household; it was rather intended for large country establishments, where ordinary gas could not be readily obtained, and in manufactories and places where a clean fuel, free from dirt, ashes, and sulphurous compounds, was required. In reply to another question, as to whether the gas was explosive, he said that all gases were explosive when mixed with oxygen in certain quantities; but owing to the large per centage of nitrogen, this one was very little explosive. In fact, he had at times found considerable difficulty in making it explode when mixed with pure oxygen and an electric spark passed through it.

Sir FRANCIS KNOWLES said that some time ago he was allowed by the proprietors of this invention to inspect their works at Battersea, when he was much struck with the extreme cleanliness and simplicity of the invention, but there was one element on which he must offer Mr. Davies his condolence, namely, the large quantity of nitrogen, which must considerably reduce the temperature of combustion, and, therefore, the effective heat of the fuel. If the inventor could succeed in getting rid of that—and he saw no reason why he should not—the temperature would be much increased. He did not know whether Mr. Davies had calculated the temperature of combustion, but that was a most important element. If to boiling water was added an equal quantity of cold water, there would be only obtained a heat much below the mean of the two temperatures, and

the introduction of this nitrogen, which was inevitable, it appeared, at present, in consequence of the combustion of fuel necessary to vaporize the water, would act in the same way as cold water, and must, of course, very much deteriorate the value of the fuel. This use of water gas was by no means novel, the only novelty being the form of the apparatus. Some years ago the proprietors of some large iron-works in the North endeavoured to apply it in their blast furnace. They collected a large quantity of it in a gasholder, their idea being that it would save fuel by blowing it through the tuyeres in combination with the ordinary blast. On writing recently to ask the result, the answer was that unfortunately, after they had worked it a short time ago with no particular advantage, owing to the neglect of a little urchin entrusted with an important function in the process, the whole affair disappeared into space, and unfortunately the little urchin disappeared with it. But he had obtained an analysis which very much differed from that in the paper. Mr. Davies had only given the analysis by volume, and not by weight. The analysis he referred to was as follows:—H 56; CO 29; CO_2 15·80; Light Carb. Hyd. ·3, so that the nitrogen was entirely absent. He did not exactly know the process by which it was manufactured, but it was so arranged as to exclude the nitrogen, and he thought it would be well worth the while of Mr. Davies and his allies to turn their attention to that point. In other respects it appeared to him a highly useful application, more particularly for domestic uses, for he considered it would be limited to that rather than being applicable on anything like a large scale in manufactures; because in the comparison with the heating power of fuel it would be found that its heating power was not so great. At the same time he did not at all wish to find fault with the invention, but simply spoke the truth in the interest of science, to point out where the imperfections lay. He should like to see a bit of platinum wire placed in the flame to test its heating power. [This was done, and the platinum wire was heated to a bright red.] He said that had it not been for the presence of nitrogen, the wire would had been of a dazzling white. He then repeated the analysis he had previously given, and added the analysis by weight—namely, H 10·51; CO 51·59; CO_2 33·26; Light Carb. Hyd. ·63. He might also say that in all these gases, which ought properly to be called wet gases—gases containing hydrogen, particularly when burnt with common air, there was a great loss of heat, owing to the generation of aqueous vapour in the products of combustion, the specific heat of aqueous vapour being very high indeed, about ·836, so that, in fact, it took away very nearly all the heat generated. There was also an enormous quantity of nitrogen imported in the process of burning this hydrogen. It would be found that all wet gases, as he might call them, produced very much less effective heat than what might be called, in comparison, dry gases, namely, those into which no aqueous vapour entered. There was the advantage in this gas that there was not any very great quantity of sulphur, and what there was, was not in a prejudicial form. As far as he could understand the apparatus, it seemed to him perfectly protected from anything like explosion; and there was not much danger of asphyxiation, which was another important point. He should like to know whether Mr. Davies had ever tried an experiment in a grate full of asbestos.

Mr. Davies said that he had tried it, but not in a very complete form, or in such a way as he would care to describe.

Mr. F. W. Hartley said he had been a good deal interested in, and connected with the manufacture of water gas, so called, and he did not believe in the necessity for the presence in such gas of so large a proportion of carbonic acid as nearly all analyses indicated, for, by proper arrangements, it was possible to resolve most of that first formed into carbonic oxide, and thereby obtain a gas which was superior to hydrogen in heating effects; because, according to the very appropriate distinction made by Sir Francis Knowles, it was a "dry" gas, while hydrogen was a "wet" one. In spite of the advantages which, at first sight, water gas, seemed to possess, it was a fact that it was inferior in heating power, as compared with coal gas. If this were so with water gas, it must be necessarily much more so with a mixture containing 56 to 57 per cent. of nitrogen, which was not only useless for heating, but worse than useless, because it prevented the flame produced by the combustible gases obtaining the temperature necessary to give the best result. Some two years ago he saw Mr. Kidd's process in operation, and was much struck with it, believing that, for smelting purposes on a small scale, the inventor had effected a very important invention, and thereby rendered a great service to the world; but he could not follow him into the conclusion that this gas could compete successfully with the gas obtained from the ordinary gas companies for the purpose of heating or lighting. With regard to heating, they were told already that it required something like five volumes of this gas to produce the same effect as one volume of ordinary coal gas. He was quite prepared to believe that it would require even more, but supposing it took only that, there would still remain the question of the cost of production; and he must say he was considerably startled by the statement that 1000 cubic feet of gas were produced from 10 lbs. of fuel. If the nitrogen were left out of the question, it came to something like 43 feet per pound of fuel employed to produce carbonic oxide, hydrogen, and carbonic acid, and he was hardly prepared readily to receive that, knowing as he did that in the production of water gas, although theory taught that, per ton of carbon used, nearly 200,000 cubic feet of gas should be produced, practice indicated quite a different thing. In America, where they had been trying this a good deal, it was found that, in order to produce 1000 cubic feet of hydrogen gas, they were obliged to employ 70 lbs. of fuel, the fuel being very analogous to the anthracite employed here. He was also startled by another statement—viz., that, following an elevation of pressure within the tube, an increased volume was obtained. He was not surprised, in one sense, for the reason that, by increasing pressure, the velocity might be increased through the tuyere or pipe, leading to an increase in volume by the addition of a larger proportion of nitrogen. He could not follow the figures showing the analysis of the gas obtained under different pressures. The difficulty he felt was to understand how, if increased pressure produced "more perfect combustion," the carbon was not to a greater extent converted into the useless gas, carbonic acid, instead of being mainly resolved into the useful gas, carbonic oxide. It seemed to him that the apparatus wanted greater depth to produce the best effects from the decomposition of the fuel, because experience had taught him that, for the best results in the decomposition of steam, there must be a tall column of carbon for it to pass through. The first impact converted the oxygen of water into carbonic acid, which by passing through a large mass of incandescent carbon took up another atom of carbon, and became converted into carbonic oxide.

Sir Francis Knowles said he might give a simple illustration of the importance of excluding the nitrogen. Every one knew that the oxy-hydrogen blowpipe gave almost the highest temperature known, which would melt platinum, but if it was attempted to burn the same gases with atmospheric air, only some of the more fusible metals could be melted. He would also suggest that nothing would be easier than to get rid of the carbonic acid altogether, by passing the whole gas through a second retort. Then if the nitrogen were also got rid of, there would be a gas of very considerable heating power.

Major Webber said that many interesting suggestions had been made, but those who were carrying on the process had for the last two years been almost overwhelmed by suggestions, nearly all of which had been experimented upon. It was very natural that when a simple apparatus of this kind had been made and tried, and its results analyzed, suggestions which involved altering the process to a great extent could not be carried far. The object of perfecting the invention of Mr. Kidd, which two years ago was in a very crude and imperfect form, had been to make the apparatus produce the best gas it was capable of producing, chiefly with the object of utilizing anthracite coal. There was no doubt that the gas was at present not perfect, but experiments had been made in the direction pointed out, and if they could be carried out on a larger scale he had no doubt better results would be produced. It was very easy to reduce the amount of nitrogen; as, if two or three generators were used, worked alternately, there would be produced, from one or other of them continuously, a gas in which the nitrogen would be reduced to from 12 to 15 per cent.; and the value of the inferior gas allowed to escape from one generator, while the superior gas was being produced in the other, was so small as hardly to affect the cost of the whole. With regard to the suggestion that a greater depth of fuel was necessary, the answer was very simple, that so long as the depth was sufficient to change the carbonic acid into carbonic oxide, leaving only the small amount which the analysis showed, this was all that was required. It had been found by experiment that the depth shown was as nearly as possible the best.

Mr. Gore said that he had had great experience in the generation of water gas, and felt considerable interest in the question. He fully concurred in the great defect of using, for heating purposes, gas in which a large amount of watery vapour was produced. There was another important matter, and that was the large proportion of carbonic oxide. He really thought the poisonous character of that gas, especially when used for domestic purposes, had not been sufficiently considered. His own impression was that the adoption of any system whereby it was to be used for domestic purposes, was so dangerous as to interfere with its practicability. Experiments had lately been going on in America with regard to it, and these pointed to the conclusion that any form of using carbonic oxide must be dangerous, and that, whatever might be done with it for manufacturing purposes, it should be avoided in households. He was convinced that ordinary coal gas was the most useful fuel which could be obtained; but then came the question whether the substitution of gaseous for solid fuel was not a step in the wrong direction.

Mr. Kenelly, after referring to the statements made by Mr. Davies as to the relative cost of coal gas and that produced by the process he had described, said that if these were true it was nonsense bringing forward theoretical considerations in opposition to them. Whether there were a large amount of nitrogen or a small amount of carbonic acid, if the same effect could be produced from that which cost ¾d. as from 10d. worth of ordinary gas—and that seemed to be the result—there was something very valuable in the process. As to the question of danger, he happened to look into a shop in the Strand a short time ago, and saw one of these apparatus at work in the basement. He did not know whether the sanitary authorities or the police were informed of it, but he saw no one looking very unhealthy or unhappy in consequence.

Mr. Brontin said that he had had his attention much directed to the question of burning anthracite in an easy form. He believed this was now accomplished, and would direct Mr. Davies's attention to the fact that a very simple apparatus, very much on the principle of the one shown, had been adapted to burn it perfectly, and was applicable to almost any boiler. It consisted in the use of a steam-jet thrown into a hollow bar perforated with holes, through which the steam escaped, and thus formed the gas of which the analysis had been given. It enabled large and small coal to be used, and there was no raking of the fire, or anything of the kind. He had very roughly gone into the question as to the quantity of heat thrown out by the gas, as compared with the ordinary use of coal under a boiler, and he found that the quantity of heat in the case of gas was 627, as against anthracite at 795, so that there would be a disadvantage in the use of coal gas as compared with coal, were it not that he had always found, both in locomotives and under ordinary boilers, there was a large amount of air admitted, which had a considerable cooling effect, so that the absolute result was not obtained from the burning of the coal. He had had a large experience in using gas with blast furnaces, and it was found impossible to do so without having a combustion chamber first, and allowing the products of combustion to pass through that which was required to be heated. The nitrogen would take up a certain amount of heat and carry it with it, and by using a Siemens accumulator it could be utilized to any extent, so as really not to lose any of the elements of heat. Coupling that with the suggestion which had been made as to the conversion of carbonic acid into carbonic oxide again, he thought the process was one which was worthy of very serious attention. He felt quite certain that the march of intellect would lead to the payment of less carriage on coal, because conveying gas would be much more simple.

Mr. Hartley said there was a great difference between using gases immediately they were produced and while in a state of incandescence, and in allowing them first to cool and then burning them.

Mr. Davies, in reply, said that one speaker had so far answered the remarks of another that there was really very little left for him to say. With regard to the danger of carbonic oxide, it might be said that every gas was dangerous. Marsh gas and olefiant gas were extremely explosive, but there was no fear of admitting them into houses, and, on the same principle, he did not think there was any danger of being poisoned with carbonic oxide. With regard to the great quantity of nitrogen, it only acted as a diluent, and carried off heat. He had shown what could be done with this gas as it stood; he had compared it with coal gas, and the experiments he had mentioned showed that, notwithstanding the nitrogen, a great heating effect could be produced from it, and at a much less cost than with ordinary coal gas.

The Chairman said there could be no doubt that if the cost of the gas was what had been stated, the system introduced a very important source of economy into domestic arrangements. The advantage of using gas in houses for the purpose of combustion was one of which there could be no doubt, provided the element of cost could be successfully met. A gas fire was so easily regulated, and was so convenient in application, that it certainly appeared to him to be a more civilized arrangement than that of burning raw fuel. No doubt there were certain questions connected with this gas which, if solved, would probably increase its heating power very considerably, but apart from that they might look upon this as a great advance in the system of heating.

A vote of thanks was then passed to Mr. Davies, and the proceedings terminated.

Hanley Sewage Farm.—On the 25th inst., an inquiry was held at the Town Hall, Hanley, before Major Tulloch, of the Local Government Board, with reference to the proposed loan of £25,000, for the conversion of Bradwell Hall Farm into a sewage farm. This step was taken owing to the action of the Duke of Sutherland with regard to the pollution of the River Trent. The Inspector having visited the farm, promised to report at an early date.

ELECTRIC LIGHTING.

[From *The Times.*]

The advancement of civilization, at least in modern times, might almost be measured by the improvements in artificial light which each recurring period of years has witnessed, and there is now much evidence to show that the public are by no means satisfied with the nocturnal illumination of our streets and houses, and that the time for further progress has arrived or is approaching. A paper on electric lighting was read a short time since before the Society of Arts, and experiments are being made in various localities. Many of our own correspondents have lately called attention to the subject; and, as it is of the highest practical importance, and likely to attract constantly increasing notice, some observations on the primary conditions of this mode of lighting may be not without interest to our readers. It may be said, as a rule, that all artificial light in common use is derived from the incandescence of particles of carbon; and, for ordinary purposes, we derive this carbon from some form of fatty matter or from coal gas. It has long been known, however, that a light of extraordinary brilliancy and power might be obtained by rendering pure carbon incandescent by means of an electric current; and this, the so-called "electric light," has been year by year rendered more manageable. Many chemists and physicists have been occupied in devising means to cheapen or otherwise facilitate its production, and it is now constantly in use in certain lighthouses. Its precise source is that the electric current, in passing from one carbon point to another across a short intervening space, renders both these points incandescent, and the resulting light, with its necessary accompaniment of heat, radiates from the points and from the intervening "electric arc" in every direction. Without entering into unnecessary details, it may be said that the production of this light, even now, is attended by several economical and practical difficulties, and that the attempts which have been made to remove them have as yet been crowned with only partial success. There seems to be no doubt that, when a strong light is wanted at some single point, it can be produced more cheaply by electricity than by common combustion; or, in other words, that a pound of coal converted into heat and made to work a steam-engine, which, in its turn, works an electro-magnet, will produce more light than the same pound of coal converted into gas and burnt in the ordinary way. When a multiple or widely diffused light is wanted, the conditions are somewhat different. If we require 50 or 100 small lights, the use of a small battery or electro-magnet for each will be more costly than gas burning, and, until lately, there has been no means of dividing the current of a large battery between many different points. It was announced not long ago that this difficulty had been overcome; but the announcement, if not inaccurate, might perhaps be fitly described as premature.

The division of a single powerful current was accomplished by a Russian *savant*, M. Jablochkoff, who also invented what he called an electric candle, to be placed at each one of the many points to which the current might be distributed. This electric candle consists of two carbon pencils placed vertically side by side, in contact at their extreme points, but separated throughout their length by a non-conducting slip of kaolin, or china clay. The weak points of the arrangement are at least two in number. In the ordinary form of electric light, in which the current passes always in the same direction, one of the carbon points is consumed more quickly than the other. This matters nothing where the two are in the same line, and are kept at a stated distance apart by clockwork; but, in the electric candle, the more rapid consumption of one carbon than of the other would soon render the interval between the points too great, so that the current would no longer traverse it, and the light would go out. In order to obviate this result, the Jablochkoff candle can only be used in connexion with an electric machine which furnishes an alternating current, so that both of the points may be consumed equally; and this is less economical than the machines which afford a current passing always in the same direction. The second difficulty is that the candles are liable to go out unexpectedly, either from momentary failure in the current, or from some analogous cause, and that when thus extinguished they cannot be relighted. For this purpose it would be necessary to bring the two carbons into momentary contact, and to such contact the kaolin presents an obstacle. The inventor has proved that the division of a current between many lights is practicable, but his success can hardly be said to have gone beyond the limits of a laboratory experiment, and the fall in the value of gas shares, by which the first announcement of the invention of the electric candles was attended, was one among the many instances which show that there may be much fear where there is little danger. The division of the current would be a most important step towards the general employment of an electric light, because it does not appear possible to light up a large space pleasantly from a single point. The rays of the sun do not fall upon visible objects in only a single direction, but in all directions, reflected from the clouds, from the earth, from all surrounding things; and it is this infinite variety of direction which produces a comparative effacement of shadow. A strong electric light, so placed as to illuminate a large area, would fall upon each of the objects therein contained only in one single direction; and it would, therefore, cast shadows of such intense blackness that every spot which was screened from its direct ray would be thrown almost into darkness. Moreover, the direct light from the carbon points is too dazzling to be pleasant, or even safe, to the eyes; and it is scarcely more easy to look at an electric beam than at the sun. The attempt to do so, in either case, is apt to be followed by temporary, or even by permanent, loss of sensibility of the retina; and there have been instances in which blindness has been produced by the use of an imperfectly smoked glass during a solar eclipse.

Our correspondents have recently described some of the attempts which have been made, both in Madrid and in Paris, to utilize electric light for public places. In the existing state of knowledge, a steady and enduring light can only be obtained by having a separate battery for each luminous point, and this arrangement is not economical unless a very large amount of illumination is required. In an open space the carbon points should be enclosed within a globe of the so-called opal or milk-white glass, which diffuses the light evenly from every part of its external surface, and thus much diminishes its intensity. Even the opal globe cannot do away with the blackness of the shadows, nor with a brilliancy which is dazzling, and which, when the eyes are turned away from it to comparative darkness, renders them for a time incapable of seeing. In a large building these inconveniences may be greatly diminished. The light should be suspended near a whitened ceiling, and should have an opaque reflector beneath it, so that the whole of the light may be first directed against the ceiling and the upper parts of the walls, and may then be reflected from them, diffused, softened, and proceeding from many points, to the objects of vision. By this method, which was lately exhibited at a meeting of the Society of Telegraphic Engineers, an almost precise imitation of daylight may be afforded, and the same principle has been successfully applied by Mr. Van der Weyde to photographic portraiture. His pictures by electric light show that his sitters have been able to keep their eyes well open, and he attains a perfection of half-tones which proves how completely the usual density of the shadows has been diminished by the incidence of the rays from different points of the reflecting surface.

On one part of the question a letter which we lately published affords a curious example of the often misleading character of the first impression made upon the senses. A correspondent described the electric light at Madrid as "a lurid glare, which gives a ghastly appearance to everything near it, and entirely destroys the effect of colour," and it would, perhaps, be difficult to put into language a statement more entirely opposed to the facts. The electric light is, in its composition and qualities, almost undistinguishable from solar light, containing the primary colours—red, green, and blue—in the same proportions, and hence displaying all colours to perfection. It is only when the carbon points are too widely separated that it contains somewhat more blue than solar light; but it differs from this in falling with greater intensity upon any given spot; so that it is dazzling just as a concentration of sunlight would be dazzling, and it modifies the aspect of all the prominent parts of an object by placing them in strong contrast with any neighbouring parts which may be in shadow. It is thus, and thus only, by intensity and by the effects of contrast, that it produces appearances which are different from those seen by ordinary daylight; and these differences, of course, are not inherent in the nature of the illumination, but depend entirely upon the particular manner in which it has hitherto been employed. They will be less conspicuous the more the electric ray, like that of sunlight, can be reflected again and again before it reaches the eyes; and this, at present, can be more readily accomplished in an enclosed space than in the open air, where a reflecting surface of sufficient extent above the light seems hardly attainable. It would probably be possible to light the Albert Hall by electricity to great perfection; and there can be no doubt that, in this case, as in so many others, science will before long remove the difficulties which still stand in the way of a more extended utilization of that artificial sun which the electric beam is calculated to afford.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The chief feature of interest connected with this district during the past week has been the strike in the Lancashire cotton trade, which, if continued for any lengthened period, will throw a large quantity of the inferior classes of fuel upon the market, and check any advance in the price of slack, which is usually looked forward to during the summer months. Already in many quarters merchants and consumers are stopping supplies of engine fuel, and the closing of many of the iron-works during the past week, for the holidays, has lessened the demand for common coal for forge purposes. For the better classes of round coal, suitable for house fire purposes, there is now very little inquiry, and where pits are working full time, stocks are accumulating. There is a good deal of pushing for orders in all descriptions of fuel, but so far as the generally quoted prices are concerned there is no material change, as colliery proprietors, in the majority of cases, seem determined to put their pits on short time rather than give way to the demands of consumers for further reductions. The average quotations at the pit mouth may be given about as under:—Best Wigan Arley, 9s. to 10s. per ton; common Arley, 7s. 6d. to 8s.; Pemberton four-feet, 7s. 6d. to 8s.; common coal, 5s. 6d. to 6s. 6d.; burgy, 4s. 6d. to 5s.; and good ordinary slack, 3s. to 4s. per ton.

In the gas coal trade there is no material change to notice beyond what I have already reported, the actual amount of business is as yet only small.

The shipping trade shows no improvement, and there is so little doing that shipowners find it extremely difficult to obtain freights.

The necessity of a reduction in miners wages continues to be urged in many quarters, but no general action has yet been proposed.

In the iron trade there has been little or nothing done, and nominally prices are without change. The general tone of the market, however, is weak. Lancashire producers of pig iron would be willing to make concessions on the list prices to secure orders, and in finished iron good specifications could be placed at very low figures.

THE COAL AND GENERAL TRADE OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

There were heavy sailings of cargoes of steam and gas coals on Friday, a large fleet of vessels having left the Tyne on that day for the Baltic and Mediterranean. Cronstadt outward rates have advanced fully 20s. per keel. A good many orders are in the market for Constantinople and the Black Sea. Freights for steamers to load gas coals to distant ports are firmer. The quotations are—Alexandria, £18; Constantinople, £15 10s.; Odessa, £16 to £16 10s.; Genoa, £15; Barcelona, £17 per keel. The coasting business from the Tyne and Wear is very quiet and dull. Rates do not change any—London, 4s. 3d.; Havre and Dieppe, 5s. 4d.; and Dublin, 6s. 6d., are the current quotations. The freight to Copenhagen is £5 15s.; and Cronstadt, £8 to £9 per keel. All outward business is firm. There are not many ready steamers in port, and, as soon as they arrive, they are taken up quickly. East India rates have advanced very considerably. The iron market is dull. Pig iron, local make, No. 1, is 48s. 6d.; No. 3, 43s. 6d., net cash. Pig lead is selling from £17 7s. 6d. to £17 10s. per ton. Dry white lead, £24; red lead, £18 15s.; flake litharge, £20 per ton. Copper, flat. Cake and ingot, £68 to £69; best selected, £72 per ton. The chemical market is flat. The manufacturing trade of the Tyne generally is very much distressed. Shipments are poor. A good deal of coke is being sent to Spain by sailing vessels.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

Owing to the increasing demands being made upon the Motherwell Gas Company for a supply of gas, it has been resolved to increase the capital by the issue of new shares. In the meantime, 500 additional shares of £1 each are to be allotted to consumers of gas.

In his official examination of the illuminating power of the Glasgow gas during the week ending the 20th of April, Dr. Wallace found that in no instance was the minimum below 26·08 candles, while in the western district it rose to 29·11 candles. The average illuminating power ranged from 26·95 candles to 29·53 candles, and the maximum from 27·39 candles to 30·24 candles.

On the 23rd inst., Glasgow Corporation Gas 9 per Cent. Annuities changed hands at £219, thus making a decline of 10s.

It is not improbable that the Dundee Gas Commissioners will soon be able to reduce the price of gas by at least 3d. per 1000 cubic feet.

The subject of the condition of the gas-pipes in the town of Kelso, which has been already referred to in the JOURNAL, was brought under the notice of the Police Commissioners at a meeting held on the 22nd inst. A short report was submitted by the Paving Committee, followed by a very elaborate and exhaustive report by Mr. John Romans, Gas Engineer, Edinburgh, the gentleman who was called in by the Paving Committee to examine and report upon the mains.

At a meeting of the Works Committee of the Dundee Water Commissioners, held a few days ago, Provost Robertson, the Convener, reported as to the accounts incurred by the Commissioners in the action brought against them by Messrs. Edington and Son with reference to the Lintra then piping. The accounts, as adjusted, included fees of counsel, Edinburgh agents, and witnesses, as well as charges for printing, &c., the total

sum being £4445 13s. 9d. It was agreed to recommend the Commissioners to authorize payment of the accounts. The Provost afterwards stated shortly the effect of the decision of the Court of Session in the claims of the Contractors, as originally made. The sum claimed was £119,873, and the sum allowed by the Lord Ordinary, after the litigation, was £105,954, the sum struck off being £13,919. Previous to the Contractor's action being raised the Commissioners offered, for a settlement of all matters in dispute, £106,654, and the Provost remarked that they might probably have given a little more had the Contractors shown any disposition to arrange amicably. After deducting the expenses incurred by the Commissioners as above stated, and £1200 found due to the Contractors as expenses, the litigation had resulted in a gain to the Commissioners of £8273.

Considerable progress has of late been made with the Dumfermline Corporation Water-Works. All the main-pipes are laid, and the water has been on to the second division for the last four or five weeks. The testing of the pipes has been attended with very satisfactory results, the leakages being chiefly due to defective turning and boring. The cistern at Glassiebarns is all but finished, and the laying of the branch pipes to Milesmark is begun. The construction of the reservoir is well advanced, the embanking having been formed to the extent of 10,500 yards, in addition to 6000 yards of excavation for the puddle trench, and 9500 yards for the outlet and waste weir channels.

The rainfall at Glencorse (Edinburgh and District Water-Works) from Jan. 1 to April 23, 1876, was 14·35 inches, as against 18·95 inches and 8·80 inches in the corresponding periods of 1877 and 1876 respectively. During the fortnight ending the 23rd inst., the delivery of water in Edinburgh was at the rate of 27·94 gallons per head per day, to a population of 286,000.

As low as 50s. 1d. cash and 50s. 1½d. eight days was paid for pig iron in the Glasgow market last Friday, and the fall in price over the week was 6½d. per ton.

There are no signs of improvement in the coal trade, and buyers seem to be under the impression that lower prices will yet be accepted.

Purchase of the Droitwich Gas-Works.—At the meeting of the Droitwich Town Council on the 16th inst., the Town Clerk stated that he had received the Provisional Order from the Local Government Board with reference to the purchase of the gas-works. They had struck out the clause with reference to the power to borrow £15,000, no sum being now mentioned, and placed the maximum price at which gas could be sold by the Corporation at 8s. per 1000 feet.

Fatal Accident to a Gas Manager.—On Saturday last an inquest was held on the body of Mr. George Smith, Manager of the Henfield Gas-Works, who died on Thursday from dislocation of the neck, caused by falling off a plank while painting the holder. The Jury returned a verdict of "Accidental death." A most distressing fact connected with this accident is that deceased had lost his wife about a year ago, and in consequence five children—the eldest ten years old—are left orphans. Mr. Smith has been connected with the gas-works since they were started.

Briton Ferry Gas-Works.—On the 17th ult. a Local Government inquiry was held by Major Tulloch, on the application of the Briton Ferry Local Board, for a loan of £4035 to extend the gas-works. It was supposed that the sum due to the bank could be included in the loan, but this the Inspector said was incorrect, and a rate must be made for the payment of the overdue account of nearly £1000. No one objected to the money being raised, therefore it is expected that ere long great changes will take place at the gas-works.

Bridgwater Water Supply.—On Friday last the first sod was cut at the site of a large reservoir at Wemborn, in connection with the water supply for Bridgwater, which is estimated by Mr. Hawksley, the Engineer engaged, to cost about £30,000. The source of supply is at the foot of the Quantock Hills, about eight miles distant, and a large number of workmen are now busily engaged in laying the pipes. Heretofore the only supply of water to the town has been derived from wells. The works are being carried out by the Corporation.

Swinton and Mexborough Gas Company.—At the annual meeting of Shareholders, the Directors reported that, notwithstanding a reduction of 3d. per 1000 feet in the price of gas, there had been a favourable year. The amount available for dividend was £1469 7s. 6d. A dividend was declare of 9 per cent. on the first and second issues, and 7 per cent. on the third issue, leaving a balance of £385 18s. 7d., which was carried to the reserve-fund, making the total of that fund £920 2s. Mr. H. Wilson was re-elected Director. Messrs. Harrop and Lockwood complained of the price charged per lamp to the Local Authorities, and the Directors agreed to consider the question.

Darwen Gas and Water Works.—The Law Clerk to the Local Board, Mr. C. Costeker, has just issued balance-sheets for the year ending the 31st December last, in respect to the above undertakings, both of which were examined and found correct by Mr. Rees, the district Auditor, on the 27th ult. The accounts in respect of the Gas Department show: *Dr.* To balance of net revenue account, £4083 15s. 5½d.; deposits, £322; do. on hired meters, £60 7s. 6d.; amount owing on open accounts, £2101 2s. 1d.; do. Manchester and County Bank, £1363 2s. 2d.; cheque issued but not drawn, £19 18s. 3d.; dividend do.; £17 5s. 3d.; balance from sinking-fund account, £705 2s. 6d.: total, £8672 13s. 2½d.—*Cr.* By amount of gas accounts owing, £6514 5s. 7d.; do. meter-rentals owing, £7 18s 3d.; do. sundry accounts owing, £768 13s. 8d.; stock-in-trade on hand, £1019 6s.7½d; balance of cash in hand, £90 0s. 4½d.; balance from capital account, £272 8s. 8½d.: total, £8672 13s. 2½d. The general summary of the Water Works Department is:—*Dr.* To sundry accounts owing, £54 7s.; balance from net revenue account, £421 4s. 8½d.; do. gas department £36 0s. 8d.; do. sinking-fund account, £1020; amount owing Manchester and County Bank, £684 13s. 2d.; cheques issued but not drawn, 5s. 9d.: total £2216 11s. 3½d.—*Cr.* By amount of water accounts owing, £258 5s. 9d.; do. fittings owing, £86 14s. 9½d.; stock on hand, £247 4s. 9½d.; balance from capital account, £1431 18s. 4½d.; cash in bank—interest account, £192 3s. 9d.; cash in hand, 3s. 10d.: total, £2216 11s. 3½d.

Discovery of Gas Coal in New Zealand.—The *Invercargill Weekly News* of the 23rd of February writes: "Large deposits of ignitable shale have been for a long time known to exist at Orepuki, and, if we remember rightly, Dr. Hector some two or three years ago reported rather favourably on samples submitted to him for analysis. But New Zealand is so rich in minerals of the kind—there were so many specimens from other places possessing somewhat similar properties—that no particular notice was taken of the report outside the then limited circle of people strongly imbued with faith in the value of the undeveloped resources of the western district. Even they, in the absence of any means for the conveyance of the mineral to market, felt that it would be next to useless to try to do anything in the way of opening out a mine, and so the discovery was allowed to remain unutilized. That it was not, however, lost sight of altogether is proved by the fact that recently Mr. Henry Hirst, of Orepuki, took the trouble to transmit, through Mr. J. R. Millo, of Riverton, to the Mayor of Invercargill, a case of the shale to be submitted to practical test by Mr. Daley, Gas Engineer. The result of the trial, as stated in that gentleman's report to the Town Council, is even more satisfactory than could have been expected from Dr. Hector's report. Mr. Daley states that for gas-making purposes it is the best sample of coal obtained in the locality he has yet experimented upon, the gas obtained from it surpassing that from grey coal, and being very rich in quality. Its only drawback appears to be that the coke is valueless as a fuel, but against this may be set its superior gas-producing quality. Under the circumstances, every one will agree with Mr. Daley as to the desirability of, as soon as possible, obtaining a sufficient quantity—he suggests two tons—for a further practical test of the shale. How to get it is another matter; to transport that quantity to Riverton would be rather costly in the meantime, as it would have to be either packed on horses all the way, or to the beach at Orepuki, and thence conveyed by boat. Still, expense should not stand in the way of settling a question of so much importance to the district. The absolute certainty of possession of a practically unlimited supply of a mineral in constant demand would certainly afford another reason for pushing on with the railway between Riverton and Orepuki, without which the gas coal, timber, and other resources of the district are of no more use to the colony than money would be to a man on an island of which he was the solitary occupant."

Coal Cleansing.—A lecture on this subject was delivered by Mr. M. Geoffrey Morgans, on the 15th inst., at the Bristol Mining School. The lecturer commenced by remarking that, owing to having made arrangements for the accommodation of other gentlemen whose names were down for lectures, whereby his own now came off two months earlier than expected, he had been unable to complete the prosecution of experiments in two branches of his subject—viz. (1), cleansing by means of centrifugal force, and (2) by means of atmospheric air as a medium for separation—and, consequently, his subject would be more or less limited to cleansing by means of liquid media. He proposed to deal first with the principles affecting the separation of different minerals by combined flotation and gravitation, and next to describe, with the aid of the numerous drawings and photographs exhibited, some of the most modern plant and machinery for carrying out those principles, directing particular attention to some practical details of construction upon which depended in a great measure the successful operation of various continental coal-washing establishments, which are greatly superior to anything at work in this country. Samples of coal, coke, and refuse products were exhibited, as well as specimens of the raw material treated in the various cases. These were the more interesting on account of being accompanied by particulars as to analyses, yields, and working costs. After illustrating the influence of form upon the descent of equivalent weights of the same description of material, the lecturer dwelt upon the importance of sizing coal, and described the best machinery for the purpose, special reference being made to "trommel," in which the various sizes of coal were discharged with the least possible travel and breakage. Of the various cases referred to, one related to an establishment where a quantity of 550 tons of coal is treated per ten-hour shift, in which the ash admixture was reduced from 18 to 3 per cent., at a working cost of 1·4d. per ton of mineral treated. Particulars of the cost of this plant were also given. The lecturer gave a very practical description of machines specially constructed for washing coal dust and slimes, which, until of late, have been discarded. In one case, accumulated slimes from earlier washing operations, containing 25 per cent. of ash, are being successfully cleansed, so as to yield a useful product containing only from 4 to 5 per cent. of ash. A very good coke made from this product was exhibited. Great strides have been made in the successful use of the same water over and over again in coal washing. This is often important where, from the danger of river pollution, it is desirable to prevent the discharge of water holding mineral particles in suspension. In some cases referred to, the escape of effluent water is entirely avoided, and the washed coal is so thoroughly drained of water that the quantity necessary to be added to compensate for loss in this direction (which is the only waste of water incurred) is surprisingly small. Time prevented the lecturer from dealing with the subject of freeing water from minerals in suspension without the aid of settling-tanks. The lecture was concluded by reference to the subject of crushing coal, and its effect upon the quality of coke as seen in various samples exhibited.

Register of New Patents.

APPLICATIONS FOR LETTERS PATENT.

1589.—Alexander, E. P., Southampton Buildings, London, "Improvements in valve cocks or faucets." A communication. April 20, 1878.

1591.—Hislop, G. R., Paisley, and Young, W., Clippens, N.B., "Improvements in revivifying spent lime, and in the means or apparatus therefor." April 20, 1878.

1604.—Longsdon, A., Queen Victoria Street, London, "Improvements in apparatus, tools, and machinery, for charging and drawing gas-retorts." April 20, 1878.

1623.—Pintsch, J., and Schülke, J., Berlin, "Improvements in the means and apparatus for kindling and extinguishing or reducing lights by electricity for signalling and other purposes." April 23, 1878.

1635.—Warner, W. J., South Shields, Durham, "Improvements in machinery and apparatus for charging and drawing gas-retorts, and for doing the work immediately in connection with them." April 24, 1878.

PATENT WHICH HAS BECOME VOID.

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

1367.—Harries, B., "A new apparatus for gauging the supply of water when used for flushing closets, domestic or other purposes, in order to prevent waste." April 15, 1875.

PATENTS WHICH HAVE BECOME VOID.

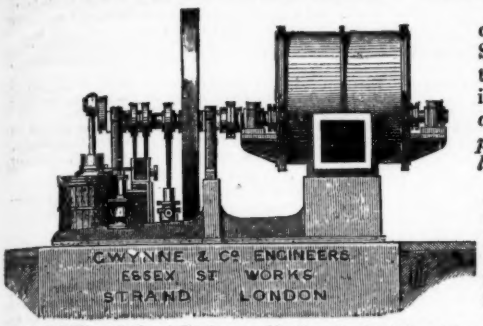
BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

939.—Hollinshead, W., "Improvements in the construction of cone or plug valves." April 10, 1871.

1036.—Spence, D., "Improvements in the treatment of spent oxide of iron arising from the purification of gas, or the said oxide when partly spent." April 19, 1871.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, and TWO MEDALS at the PHILADELPHIA EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

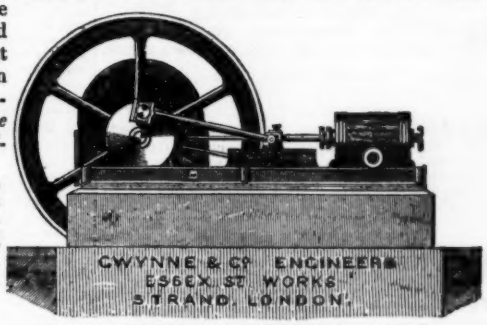
GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"*Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship.*"

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 7,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



52,500 EXHAUSTER, with Horizontal Engine combined.

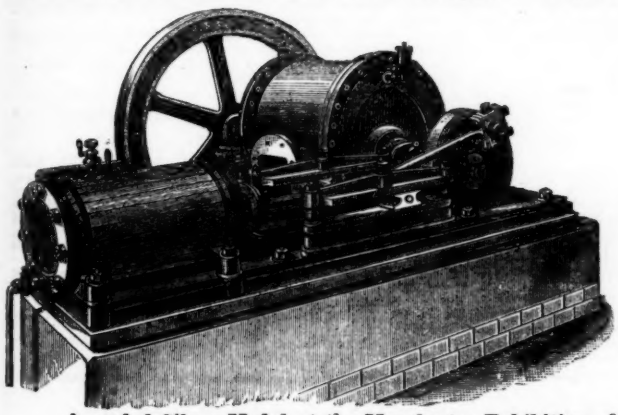
GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, *but to produce machinery of the very highest quality, and most approved design and workmanship.* The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

Exhausters, with or without Engines combined, can be made to pass the gas without oscillation or variation in pressure Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

PLEASE ADDRESS IN FULL, GWYNNE & CO., Hydraulic and Gas Engineers, ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.

Gwynne & Co.'s New Catalogue on Gas-Exhausting and other Machinery may be obtained on application at the above Address.

BEALE'S IMPROVED PATENT GAS EXHAUSTERS



WITH

Wrought-Iron Spindles and

ENGINES COMBINED.

SOLE MAKERS,

GEORGE WALLER & CO.

MAKERS OF ENGINES, EXHAUSTERS, INDEX AND DISC GAS-VALVES, HYDRAULIC MAIN VALVES, BYE-PASS VALVES, TAR, LIQUOR, AND OTHER PUMPS, SCRUBBERS AND PURIFIERS, CONDENSERS, BOILERS, &c.

Awarded Silver Medal at the Manchester Exhibition of the Society for the Promotion of Scientific Industry.

Phœnix Engineering Works:

HOLLAND STREET, SOUTHWARK, S.E.

TO GAS ENGINEERS.

D. BRUCE PEEBLES & CO.

Beg to call the attention of Gas Engineers to the fact that the novel and original feature in connection with PEEBLES' SYSTEM OF CONTROLLING THE ACTION OF GAS GOVERNORS is the loading or acting on the Bell by Pneumatic Pressure instead of Weights.

TAY WORKS. BONNINGTON, EDINBURGH.

A Young Man, who has had experience in the Photometric and Chemical Testing of Gas, and is able to keep Accounts, wishes for employment in Gas-Works.

Address No. 456, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a re-engagement as Working MANAGER of Gas-Works. Has a practical knowledge of Retort Setting, Main, Service, and Meter Fixing, and Indoor Fitting. Could enter on his duties immediately. Unexceptionable references.

Address No. 453, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

A Gentleman, nearly Four years Assistant Engineer on Gas-Works producing over 200 millions, wishes a similar engagement, or the Management of a Works. Reason of leaving was illness. Good references.

Address G. A. D., Mabledon Farm, TUNBRIDGE.

AGENTS required for the Sale of a First-class Positive Water-Meter. No one need apply who has not a good connection amongst Water Companies.

Apply, with references, to Union Water-Meter Company, 4, New Broad Street, LONDON.

WANTED, Readers of the Pamphlet, "Cooking and Heating by Gas; on Burners," &c. Copies, by post, Threepence, direct from the Author, MAGNUS OHREN, Gas-Works, SYDENHAM, S.E.

A Gentleman, aged 38, who has been Engineer and Manager of Gas-Works at home and abroad for 14 years, and with some thousands of pounds at command, desires to join a Consulting Gas Engineer, in extensive practice, with a view to partnership. Or he would join some respectable firm of Contractors and Gas Apparatus Manufacturers, or enter into partnership with a Lessee of Gas-Works.

Apply, by letter only, to No. 457, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by Samuel Thompson & Co., Colliery Office, Lancaster, APPLICATION for PRICES from Gas Managers who are prepared to receive Tenders for GAS COAL or CANNEL.

John Leigh, Esq., M.R.C.S., F.C.S., &c., &c., in his analytical report of S. T. & Co.'s Coal, says: "It is remarkable for its purity, I have scarcely ever examined a Coal containing so small a quantity of ash, and when Cannel of the best description is scarce, it may well replace this material."

THE Advertiser seeks an engagement as FOREMAN of Retort Setters or RETORT SETTER by Contract or Day. Has been sole retort setter to the Crystal Palace District Gas Company for the past six years. Good references.

Address W. ROBUS, 31, Vance Street, Walpole Road, NEW CROSS, S.E.

WANTED, a Gas-Fitter and Service LAYER, capable of Repairing Meters, Wet and Dry.

Apply, in own handwriting, stating wages required, and copy of certificate for good character and workmanship indispensable, to No. 455, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SULPHATE OF AMMONIA PLANT.

THE above Plant, erected on the newest and most improved method, at less than half the cost of other plans, gives better results, requires less labour, and allows no gases or offensive smell to escape. Reference kindly permitted to manufacturers as to efficiency and cheapness of plant &c.

For particulars, address JOHN G. HARVEY, Chemical Works, Little Island CORK.

CORK GAS CONSUMERS COMPANY.

WANTED, a Meter Inspector to superintend Staff in charge of from 4000 to 5000 Consumers Meters, Check registration, water-lines, &c.

Applications, enclosing copies of testimonials, and stating salary required, to be addressed to the SECRETARY, 72, South Mall, CORK.

SHAFTESBURY GAS-WORKS.

WANTED, Quotations for Tar and Liquor, delivered in barrels at Railway Station, Semley.

Address to THORNELOE and Co., Lessees, 57, Barbican, LONDON, E.C.

WANTED, Orders for Samples to test the superior Silkstone, Wigan, and other Gas Coals and Cannel on Sale by G. J. EVESON, Gas Coal and Cannel Contractor, BIRMINGHAM.

N.B.—Prices on personal application, or by post or telegram, on shortest notice, and prompt delivery.

SPENT OXIDE OF IRON.

WE are open to Buy this in any quantity.

Address, with price, to NICHOLSON AND SONS, Chemical Works, Hunslet, near LEEDS.

FOR SALE—A First-Class Station-METER, to pass 20,000 cubic feet per hour. May be seen at work. It is to be disposed of to make room for one of greater capacity.

Apply to E. GODDARD, Gas-Works, IPSWICH.

GASHOLDER, now at work, and in good condition, FOR SALE: 45 ft. diameter, 18 ft. deep; Six Columns and Girders, with Chains and Balance-weights.

Apply to the Horseley Company, Limited, Tipton, STAFFORDSHIRE.

ON SALE—One Station-Meter, to pass 1000 cubic feet per hour. Almost new. Will be sold cheap.

Apply to J. HALL, Gas-Works, St. Helen's, LANCS.

THE Directors of the Whitehaven Gas-light Company, Limited, are prepared to receive TENDERS for the purchase of the AMMONIACAL LIQUOR made at their Works.

Tenders will be received on or before Monday, May 6.

The Directors are not bound to accept the highest or any tender.

S. STUDHOLME, Manager.

COAL CONTRACT.

THE Directors of the Southwark and Vauxhall Water Company are prepared to receive TENDERS for about 20,000 Tons of STEAM COAL, of the kinds set forth in the specification, delivered into store at the several pumping stations.

Specifications and form of tender can be obtained at the Engineer's Office on payment of 21s., and the same must be forwarded not later than May 14, 1878, addressed to the "Chairman, Southwark and Vauxhall Water Company, Sumner Street, Southwark, S.E.," endorsed "Tender for Coal."

By order.

SCARBOROUGH GAS-WORKS.

THE Directors of the Scarborough Gas Company are prepared to receive TENDERS for certain Works, in extension of their New Gas-Works, consisting of a Retort-House and Chimney Shaft, a Coke-Shed, a Boundary Wall, Retorts, Retort Fittings, and other works.

The drawings and specification may be seen, and a form of tender, comprising a bill of quantities, may be obtained, at the Offices of Mr. G. W. Stevenson, 4, Westminster Chambers, London, S.W., and at the Company's Office, 27, Queen Street, Scarborough, on and after Friday, May 3, and tenders must be delivered at my Office, in Scarborough, at or before noon on Tuesday, May 14.

JAMES MOON, Secretary and Manager.

Scarborough, April, 25, 1878.

CORPORATION OF NOTTINGHAM.—GAS DEPARTMENT.

TENDERS FOR COALS.

THE Gas Committee are desirous to receive OFFERS for Supplies (amounting in the aggregate to 80,000 tons) of SOFT COALS and SOFT COBBLES or NUTS, for the period terminating April 30, 1879.

The Large Coals and the Cobbles or Nuts are to be separately delivered, where and as from time to time directed, by and at the expense of the Contractors, upon the Gas-Works Railway Siding, in the East Croft, at Nottingham, and at the Midland Company's Railway Station, at Nottingham, and also on the Gas-Works Railway Sidings, at Radford and Basford respectively; and at and after the rate of one-eight part of such total quantity in each calendar month, commencing with the month of July next, till the Corporation shall be satisfied with the amount of accumulated stock, and afterwards at such rate as shall be from time to time directed, till the agreed quantity shall have been delivered.

The Corporation will undertake to receive from each person or firm whose tender may be accepted, a total quantity of 5000 Tons at the least; but they do not bind themselves to accept the lowest or other tender or tenders, till after a satisfactory trial of the Coals and Cobbles or Nuts, to which such tender or tenders may relate, shall have been made. They are to be the best of their kind, *well screened*, and as free as possible from sulphur, bats, bind, refuse, and dirt, and shall be weighed (20 cwt. to the ton) upon the Corporation machines, or upon such other machines as may be mutually agreed upon.

Payments will be made monthly, if and so long as the contract shall be duly fulfilled, to the extent of nine-tenths of the amount of the verified invoices, and the balance will be discharged on the satisfactory completion of the contract.

Further information, and forms on which the tenders must be made, may be obtained on application to Mr. J. WILSON, at the Gas Offices; and the tenders (sealed) specifying the description of Coals and the pits at which they are to be raised, and stating the prices for deliveries at the several places and in manner and subject to the conditions aforesaid, must be delivered to SAMUEL GEORGE JOHNSON, Esq., Town Clerk, on or before Monday, the 20th day of May next.

By order,
M. OGLE TARBOTTON, Borough Engineer.
Corporation Gas Offices, George Street,
Nottingham, April 18, 1878.

SAMUEL DARWIN,
GAS ENGINEER,
54, WEST STREET, BUXTON,

May be consulted on all affairs connected with the Management of Gas-Works, Machinery, Valuation, or Arbitration, and is also prepared to lease, or advise on leasing, Gas-Works, or making Gas by contract.

TO GAS COMPANIES AND OTHERS.

THE Stalybridge Gas Company have for Sale, at their Mossley Works—

One 14-inch Station Governor.

Two lengths wrought-iron Hydraulic Main, 20 in. diameter, each 39 ft. 10 in. long, fitted for Emmott's ovens; with all the necessary pipes, cast-iron fronts, mouthpieces, &c., for 8 ovens.

Also wrought-iron Buckstaves, made of 6 in. angle iron, 6 double and 4 single, each 9 ft. 5 in. long, and wrought-iron Lids for retorts and ovens as above.

The Company have also at their Stalybridge Works—

One 12-in. Centre Valve for 4 purifiers, Newton, Chambers, and Co.'s make.

Four wrought-iron Purifier Covers, 12 ft. 6 in. square and 15 in. deep, weighing about 16 cwt. each, together with cast-iron Girders and Lifting Gear complete.

All the above are in good condition, and may be seen on application to Mr. ROBERT HUNTER, Manager, Gas-Works, Stalybridge, of whom any further particulars may be obtained.

Stalybridge, April 11, 1878.

LLANDUDNO IMPROVEMENT ACTS.

GAS-WORKS CONTRACT, No. 4.

WANTED, Tenders for Wrought and Cast Iron Plant and Materials.

Form of tender, bill of quantities, schedule for prices, and specification will be forwarded in duplicate on payment of one guinea, one-half of which will be returned to every contractor supplying a *bonâ fide* tender.

Sealed tenders, endorsed "Tender for Wrought and Cast Iron Work, Gas-Works Contract, No. 4," to be addressed and forwarded, post paid, to the undersigned not later than the morning postal delivery of Saturday, May 18, 1878.

The Commissioners do not bind themselves to accept the lowest or any tender.

THOS. T. MARKS, C.E.,
Engineer to the Commissioners.
Llandudno, April 27, 1878.

TO MANUFACTURING CHEMISTS AND OTHERS

THE Directors of the Staines and Egham Gas and Coke Company, Limited, are prepared to receive TENDERS for the purchase of the whole of the AMMONIACAL LIQUOR produced at their Works at Egham, for a term of One, Two, or Three years, commencing from the 1st of June next. The pumping will be done by the Company's machinery.

Further information may be obtained of the Manager, Mr. Thomas Webb, at the Works.

Sealed tenders, marked "Tender for Liquor," to be sent to the Secretary, on or before the 2nd of May next.

JOHN ANTHONY ENGALL, Solicitor and Secretary.
Staines, April 18, 1878.

BUCKS COUNTY LUNATIC ASYLUM.

TO GAS ENGINEERS AND FITTERS.

THE Committee of Visitors of this Asylum invite APPLICATIONS from tradesmen to Repair the present Gasholder at their Works; to Remove the present Condenser and Refix it; to Supply two new Purifiers, 6 ft. by 3 ft., with the necessary Valves and Connections, and also to Supply two new Circular Retorts, 6 ft. 9 in. long and 15 in. in diameter, inside measure, and to execute all the work requisite for fixing the same.

A more detailed description of the whole of the work will be given on personal application to the Resident Medical Superintendent at the Asylum, and the Engineer there.

Tenders to be sent to me not later than the 14th of May next.

ACTON TINDAL, Clerk to the Committee of Visitors.
County Hall, Aylesbury, April 18, 1878.

COMPLETION OF THE FIRST VOLUME
OF
KING'S TREATISE
ON THE
SCIENCE AND PRACTICE OF THE MANUFACTURE & DISTRIBUTION
OF
COAL GAS.

EDITED BY THOS. NEWBIGGING, C.E., AND W. T. FEWTRELL, F.C.S.

On the 1st of May will be published No. 18, containing Title-page, Table of Contents, Lists of Plates and Illustrations, and a full-page

COLOURED ENGRAVING OF THE BECKTON GAS-WORKS,

Forming a Frontispiece to the First Volume of this important Work, completed with the present number.

On the 21st of May will be ready, price 28s., handsomely bound in Morocco, cloth sides, gilt edged and lettered, Vol. I.

This Volume contains 460 pages of Letterpress, and is illustrated by 521 Woodcuts and 37 page and double-page Engravings, printed on Plate paper.

SUBSCRIBERS NAMES RECEIVED BY THE PUBLISHER,
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METALLIC OXIDE PAINT,

Specially adapted for painting Iron and Woodwork in and about **Gas-Works**, as it is not affected by the ammoniacal gases always present, but will keep its **Colour and Hardness** under the most trying circumstances; it forms a very hard surface, and effectually prevents iron from corroding; it will not crack or blister, and resists alike the heat of summer and the cold of winter.

Used extensively throughout Lancashire, Yorkshire, and neighbourhood. Among our customers are the following:—The Manchester and Salford Corporations; the Gas Companies at Rochdale, Sowerby Bridge, Halifax, Stalybridge, Blackburn, Leigh, St. Helen's, &c.

Supplied mixed ready for use, or in stiff paste.

J. E. WILLIAMS & CO., VICTORIA PAINT WORKS, COLLYHURST, MANCHESTER.

BOLTON CORPORATION GAS DEPARTMENT.

CONTRACTS FOR CANNEL AND COAL.

THE Gas Committee are desirous of receiving TENDERS for CANNEL and BEST SCREENED GAS COAL, for One, Two, or Three years, commencing 1st of July next, to be delivered free at the Bullfield or Craddock Lane sidings of the Lancashire and Yorkshire Railway, at Bolton; or, if carted, at the Gas Street or Lum Street Works, as may be required.

Sealed tenders, endorsed "Tender for Coal," specifying the description of Cannel or Coal, the pits at which they are to be raised, and the quantities proposed to be supplied, to be sent to the undersigned, at or before Ten o'clock a.m., on Monday, the 6th of May, stating also cash terms for monthly payments.

The Committee do not bind themselves to accept the lowest or any tender, but the person or persons whose tender may be accepted will be required to execute an agreement for the due performance thereof.

By order,
R. G. HINNELL, Town Clerk.

Gas Offices, Bolton, April 5, 1878.

THE Directors of the Glossop Gas Company are prepared to receive TENDERS for the supply of
1200 Tons of best Cannel (screened),
2800 Tons of best Gas Coal (screened or unscreened),
200 Tons of best Gas Nuts (screened),
To be delivered in such quantities as the Manager may from time to time require, during the year from July 1, 1878, to June 30, 1879.

The Directors do not bind themselves to accept the lowest or any tender, and reserve the right to divide the contract.

Sealed tenders, endorsed "Tender for Cannel or Gas Coal," giving description of Cannel or Coal, the pit at which it is raised, and the price per ton of 20 cwt., delivered free either at the Gas-Works or Glossop Station of the Manchester, Sheffield, and Lincolnshire Railway Company, to be sent to the undersigned, not later than Friday, May 10, 1878.

By order of the Board,
JAMES DALGLIESH, Manager, &c.

Gas Offices, Glossop, April 20, 1878.

WILSON CARTER AND PEARSON,
GAS COAL AND CANNEL FACTORS,

Supply to any Railway Station or for Export all kinds of Fuel for Gas purposes.

Address—CHIEF OFFICES:
TEMPLE BUILDINGS, 50, NEW STREET, BIRMINGHAM.

ECONOMY IN THE PRODUCTION OF GAS.

PLUTONIC CEMENT,

For Jointing and Repairing Retorts and Ovens *in* action and *out* of action.

A Pamphlet on the advantages of the above, with modes of Application, References, Prices, &c., free by post, from the Sole Manufacturer,

WILLIAM RICHARDSON, GAS AND HYDRAULIC ENGINEER,
CHARLES HENRY STREET AND BISSELL STREET, BIRMINGHAM.

GAS PURIFICATION.

BAILES & HALLSWORTH,
CONTRACTORS FOR THE
PURIFICATION OF COAL GAS
BY THEIR
PATENT HYDRATED PEROXIDE OF IRON MATERIAL.

The Material is adapted specially for taking up sulphuretted hydrogen, and will simultaneously absorb any ammonia that may pass the scrubbers.

The spent oxide resulting from our Material is more valuable than that from natural oxide of iron, and manufacturing chemists buy it in preference.

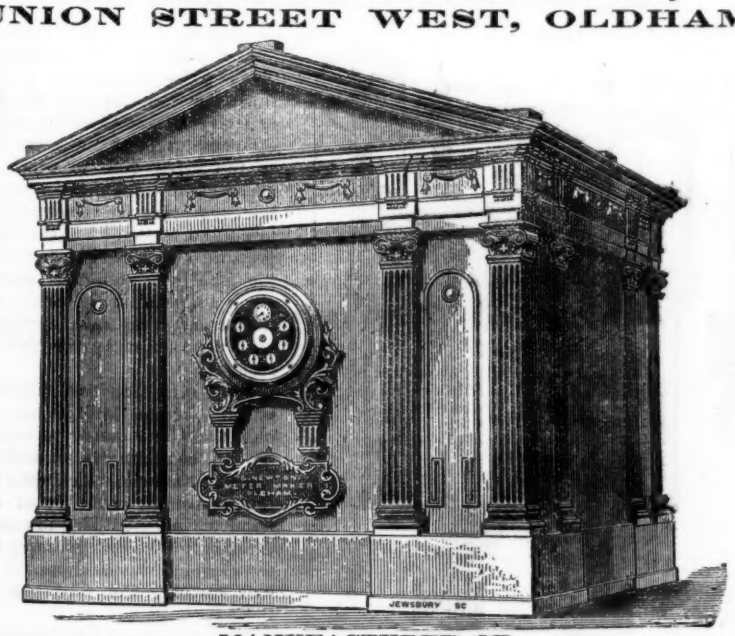
The Material has now been in use during the past three years in most of the principal Gas-Works in Yorkshire and elsewhere.

It contains considerably less moisture than natural oxide of iron, and is much cheaper and more efficient as a purifying agent.

B. & H. are purchasers of Spent Oxide, or will take Spent in exchange for New Material.

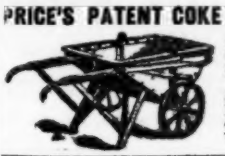
FOR SAMPLES AND TERMS, ADDRESS—
BAILES & HALLSWORTH, COPPERAS WORKS, ARMLEY, LEEDS.

GEORGE NEWTON,
UNION STREET WEST, OLDHAM,



MANUFACTURER OF
SQUARE STATION-METERS, with PLANED JOINTS;
ROUND STATION-METERS, WITH CAST-IRON STANDS;
WET AND DRY CONSUMERS GAS-METERS, GOVERNORS, &c.

PRICE'S PATENT COKE & COAL BARROW



effecting a great saving of time, labour, and expense.

For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, Gas-Works, Hampton Wick, MIDDLESEX.

JAMES NEWTON & SONS,
(Established 1820,)
FIRE-BRICK AND TILE MERCHANTS,
Wholesale and for Exportation,
FALCON DOCK, 78 AND 79, BANKSIDE,
SOUTHWARK, LONDON, S.E.,
DEPÔT for STOURBRIDGE AND NEWCASTLE FIRE-BRICKS, LUMPS, TILES, and FIRE-CLAY,
and every Article suitable for
GAS AND WATER WORKS.

WILSON'S
SAFETY
AUTOMATIC PRESSURELESS DIP-PIPE,
SELF-CLEANING HYDRAULIC MAIN.
See Illustration and Description in JOURNAL OF GAS LIGHTING, *Dec.* 4.

Improved SCRUBBER, with Self-Acting Water Distributor.
Improved HYDRAULIC CENTRE-VALVE to work three or four purifiers.
Improved HYDRAULIC LIFT, by which one man can raise and remove purifier-covers of any size.
Plans and specifications prepared for New or for the Remodelling of existing Gas-Works.
Special Designs for Gas-Works for Tropical Climates.
Particulars, &c., to be had of the Patentee, Inventor, and Manufacturer, W. P. WILSON, Consulting Engineer, 80, Cannon Street, LONDON, E.C.

CLOTH GAS-BAGS FOR MAINS,

As supplied to the Imperial, Chartered, and other London and Provincial Gas Companies. Bellows and Valves for inflating Well Dresses, Stokers Gloves, India-Rubber Suction and Delivery Hose, Gas-Tubing, Leather, India-Rubber, and Gutta-Percha Machine-Bands, Sheet and Washers, and Steam Joints.

T. BUGDEN, Manufacturer,
107, GOSWELL ROAD, LONDON, E.C.

M. BREMOND'S NAPHTHALINE PROCESS.

All negotiations respecting M. Brémond's patented process for preventing Deposits of
NAPHTHALINE
in Gas Main and Service Pipes should be addressed to Mr. W. H. BENNETT, 22, Great George Street, WESTMINSTER, S.W., or to M. BREMOND, Gas Engineer, Compania Madrilena de Alumbrado y Calefaccion por Gas, MADRID, who may be consulted upon all matters connected with the Gas Industry.

THOMAS CARR & SON,
MANUFACTURERS OF
FIRE-BRICKS, LUMPS, TILES, RETORTS, &c.,
SCOTSWOOD FIRE-BRICK WORKS, SCOTSWOOD-ON-TYNE.
Also Makers of all kinds of Common Building Bricks, and of Pressed White and Red Bricks for Facing.

GRIRDROD'S PATENT
PORTABLE PIPE SCREWING MACHINE,

For 1 in., 1¼ in., 1½ in., and 2 in. Gas Threads, complete £7 10s.

In use at the chief gas-works, and giving great satisfaction.

For other useful goods, see Bailey's "Illustrated Inventions," post free 3s. 6d.; gratis to ledger customers.

W. H. BAILEY & CO.,
Brassfounders, Gauge Injector and Tool Makers,
ALBION WORKS, SALFORD,
LANCASHIRE.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.

Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

Patents procured for Foreign Countries.

Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 22, Great George Street, WESTMINSTER.

BIRTLEY IRON WORKS,
CHESTER-LE-STREET,
DURHAM.
Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.
Warehouse in London for Cast-Iron Pipes and Connexions of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.
Agent in London, Mr. J. MANWARING, 101 Cannon Street, E.C.

BOUCK & CO., LIMITED,
TAR DISTILLERS & MANUFACTURING CHEMISTS,
MILES PLATTING, MANCHESTER.
BRANCH WORKS, BLACKBURN.

BUYERS OF COAL TAR,
And Crude Products therefrom,
AMMONIACAL LIQUOR, &c.

MANN & OWENS
PATENT SCREW & CAM GAS-VALVES.
SIZES from 2 In. to 48 In.

As supplied to
THE GASLIGHT & COKE CO., LONDON:
The CORPORATIONS of MANCHESTER, BIRMINGHAM, CARLISLE, OLDHAM, STOCKTON, HALIFAX, &c.
And to the following Companies—viz.:
PHŒNIX, SOUTH METROPOLITAN, BRENTFORD, WINDSOR ROYAL, IPSWICH, WEST HAM, BILSTON, ARUNDEL, DUDLEY, ST. HELEN'S, MORECOMBE, THRAPSTONE, &c.,
And to the various WORKS of the
BRITISH GASLIGHT COMPY.
Every Valve warranted perfectly Gas-tight.

SOLE MAKERS, S. OWENS & CO.,
ENGINEERS,
WHITEFRIARS STREET, LONDON.
PRICES ON APPLICATION.

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SOLE PROPRIETORS AND MANUFACTURERS OF
WOLSTON'S CELEBRATED
TORBAY IRON PAINTS.

TRADE MARK

These Paints have been for many years extensively used in Her Majesty's Royal Dockyards, Woolwich Arsenal, the Shorncliffe and Curragh Camps, War Departments, and Colonies, and are largely supplied to Railway, Harbour, and GAS COMPANIES, Shipowners, Engineering Establishments, Railway Carriage and Wagon Works, and the Paint Trade generally. They are the BEST PROTECTORS of WOOD, CEMENT, and IRONWORK, even arresting corrosion after it has set in; and their base being oxide of iron, they are free from those properties which make lead paints so destructive to iron. They do not scale or blister, are not affected by great heat, and are the only Paints which will resist the effects of sulphuretted hydrogen. Their DURABILITY and covering properties have borne the test of A QUARTER OF A CENTURY'S PRACTICAL TRIAL.

The undermentioned colours—ground in best linseed oil, and requiring only to be thinned down for use in the ordinary way—are kept in stock:—

Torbay Brown.	Torbay Red.
Dart Green.	Slate.
Dart Yellow.	Buff.
Brixham Black.	Torbay Chocolate.
Light Blue.	Cream Colour.
Dart Brown.	Dart Umber.
Imperial Stone.	Light Stone.
Bronze Green.	Salmon Colour.
Navy Green.	Lead Colour.
Carriage Red.	Dark Stone.
Light Lead.	Crystal Palace Blue.
Light Green.	Iron Grey.

All other Colours made to order.

READY-MIXED PAINTS.

A great variety of Colours ready mixed for the brush are also always kept in Stock, in 3 lb., 7 lb., 14 lb., and 28 lb. cans.

Prices and Testimonials on application.

GREAT SAVING OF LABOUR.
ENOCH'S PATENT
PORTABLE DRILLING-MACHINE,
Now in use by all the Principal Gas and Water Companies in the United Kingdom.

E Size, for Services in Pipes, 2 to 3 in. bore	£3 10 0
F Size, for Services in Pipes, 2 to 4 in. bore	4 0 0
G Size, for Services in Pipes, 2 to 6 in. bore, with Telescope Cramp.	4 10 0

Drills, 1s. 6d. each.
Machines sent on approval, if desired.
Prices for other Sizes and Modifications, with full Particulars and Testimonials, on application to
ALEXANDER ANDERSON,
Office: 9, London Street, E.C. Warehouse: Vine Street, Minories, London, E

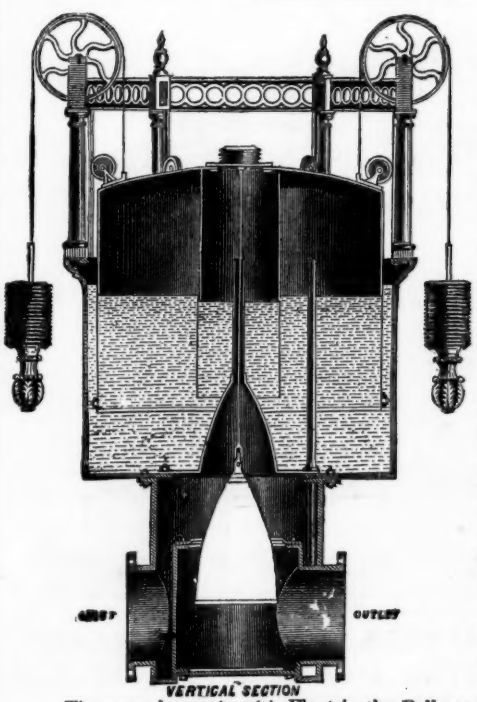
J. BEALE'S NEW PATENT GAS EXHAUSTERS,
MANUFACTURED SOLELY BY
B. DONKIN & CO.

These Exhausters have but one solid slide, which ensures less wear and tear, and less friction, and thus fewer repairs are necessary. They are made with two outside bearings and all latest improvements.

MESSRS. B. D. & CO. ALSO MAKE
STEAM-ENGINES FOR DRIVING GAS EXHAUSTERS.
VALVES FOR GAS, WATER,
STEAM, HYDRAULIC MAIN, TAR, AMMONIACAL LIQUOR, &c.

WORKS: 55a, BLUE ANCHOR ROAD, BERMONDSEY, LONDON, S.E.

J. & J. BRADDOCK,
GLOBE METER-WORKS,
OLDHAM,
Beg to submit to Gas Engineers their
PATENT COMPENSATING GAS GOVERNOR,
Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



VERTICAL SECTION

The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 24-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

NOTICE.

THE GAS & WATER COMPANIES DIRECTORY, 1878.

(WATER SECTION.)

The Editor will feel greatly obliged if Secretaries and Engineers would fill up, and return to him at once, the forms sent them, as the work is now going to press. If any have not received Forms, they will be forwarded immediately, on application to the Editor,

CHARLES W. HASTINGS,
8, BUCKINGHAM STREET, ADELPHI, LONDON, W.C.

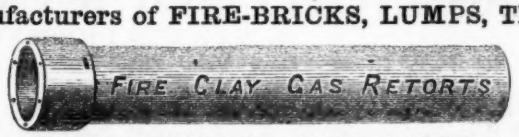
JAMES MILNE & SON,

GAS ENGINEERS,
Gas-Meter, Gas Apparatus, and Gas-Fittings Manufacturers,
EDINBURGH, AND
2, KING EDWARD STREET,
NEWGATE STREET, LONDON.
Meter Works in London—2, CROSS STREET, WILDERNESS ROW, E.C.

STATION-METERS, GOVERNORS, CONSUMERS METERS, GAS LUSTRES, CHANDELIERS, BRACKETS, &c.,
And every description of Gas-Fittings and Gas Apparatus.

JOHN HALL AND CO., STOURBRIDGE,

Manufacturers of FIRE-BRICKS, LUMPS, TILES,



AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.
N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.

GEORGE ANDERSON,

GAS AND CONSULTING ENGINEER,
35A, GREAT GEORGE STREET,
WESTMINSTER, S.W.,
PATENTEE and MANUFACTURER of the following Invention
RETORT SETTINGS—giving great Economy of Fuel.
STEAM-ENGINES and EXHAUSTERS, FOUR-WAY VALVES, WASHERS, SCRUBBERS.
FUEL-MACHINE, for Compressing Breeze and Tar.

N.B.—Pamphlet, with Eighteen Illustrations and Letterpress on the Construction of Gas-Works, post free, 2s. 6d.
PRICES AND ALL PARTICULARS TO BE HAD OF THE PATENTEE,
35a, GREAT GEORGE STREET, WESTMINSTER, S.W.

CANNEL COAL.

ELLIS LEVER & CO., Central Coal Offices, 46, Cannon Street, London, E.C., and 6, Piccadilly, Manchester, are prepared to contract for the supply of THE BEST CLASSES of CANNEL and GAS COAL, for long or short periods. Analysis and prices on application.

ELLIS LEVER & CO.,

CANNEL AND GAS COAL CONTRACTORS,
Shippers of Steam and House Coal
AT ALL
ENGLISH, SCOTCH, AND WELSH PORTS.

46, CANNON STREET, LONDON,
AND
6, PICCADILLY, MANCHESTER.

Just published,
PAMPHLET ON
DIP-PIPES AND HYDRAULIC MAINS
v.
DESICCATED COAL GAS.
By WM. WHITE,
GAS-WORKS, ABERSYCHAN, MON.
A Copy sent post free for 6½d. upon application to the Author.

Design and Work, March 30, 1878, has the following review of this pamphlet:—"To all connected with the manufacture and distribution of gas we commend a perusal of this sixpenny pamphlet. The author is a thoroughly practical man, and what he has to say he says in a way his 'fellows' can best understand. We venture to predict that by-and-by Mr. White and his pamphlet will be better known than they are now, and probably to the benefit of both producers and consumers of gas."
See also the Editorial Article on "White's Automatic Gas-Valve," in the *Gas Trade Circular and Review* March 29, 1878.

ALFRED LASS,

SPECIAL ACCOUNTANT FOR GAS COMPANIES,
30, GRACECHURCH STREET, LONDON.

Accounts analyzed and Statistics Prepared for Parliamentary Proceedings, Arbitrations, &c.
The Forms of Account, which have been specially designed by A. L. to meet the requirements of the Gas-Works Clauses Amendment Act, 1871, are now in use by many Gas Companies, and have been universally approved.
The above forms are registered.
Water Companies Accounts also prepared and adjusted.
CONSULTATIONS.

T. NEWBIGGING,

CONSULTING GAS ENGINEER,
5, NORFOLK STREET, MANCHESTER.

MR. EDWARD SANDELL,

Associate of the Society of Accountants in England,
Publisher of the
"Gas Companies Expenditure Journal,"
Begs to announce his REMOVAL from Skinner's Place, Size Lane, to
No. 2, GT. GEORGE STREET, WESTMINSTER.

Prices, half bound, cloth sides, 2 quires, 30s.; 3 quires, 36s.; other sizes and bindings to order.
THE
GAS COMPANIES EXPENDITURE JOURNAL,
Being a Ruled Account-Book with Printed Headings, and Analyzing Guide for Keeping, upon the easiest and most correct method, the Expenditure of a Gas Company, in accordance with the provisions of the Gas-Works Clauses Act of 1871, and suitable for all Companies.
Published by EDWARD SANDELL, Accountant, 2, Great George Street, WESTMINSTER, and W. B. KING, Office of the JOURNAL OF GAS LIGHTING, 11, Bolt Court, FLEET STREET, E.C.

Mr. ROBERT DEMPSTER, Sen.,

CONSULTING GAS ENGINEER,
Of Messrs. Robert Dempster and Sons, Rose Mount Gas Engineering Works,
ELLAND, near HALIFAX,
May be consulted on all matters connected with Valuations, Arbitrations, and Parliamentary Applications connected with Gas-Works. Our R. D., Sen., having been engaged on extensive Arbitration Cases, which, combined with his experience in Construction and Contracting, his knowledge of Engineering and Valuations, is both extensive and reliable.

REMOVAL.
CHARLES HEISCH, F.C.S., Analytical and Consulting Chemist, Superintending Gas Examiner to the Corporation of London, &c., &c., has REMOVED from 8, Savage Gardens, to 79, MARK LANE, where he may be consulted as usual.

JOHN ROMANS, C.E., F.G.S.E.,

CONSULTING GAS ENGINEER
AND
CANNEL COAL FACTOR,
30, St. Andrew Square, EDINBURGH.

Plans and Estimates furnished; Gas-Works, Apparatus, Pipes, Machinery, Fire Goods, &c., supplied, or Attested and Shipped for Exportation.
GAS-WORKS TAKEN ON LEASE.

Mr. ROMANS has for upwards of 30 years been practically engaged in the Manufacture of Gas, and has, by extensive experiments, ascertained that by JUDICIOUS INTERMIXTURE of the lighter with the heavier gases, much of the rich Hydrocarbons CAN BE SAVED, which otherwise ARE LOST, during the process of manufacture. He is therefore enabled to give advice to those who favour him with their orders for Cannel, as to the class which will secure for their standard of illuminating power the HIGHEST ADVANTAGEOUS RESULTS.

ANALYSIS AND PRICES FORWARDED ON APPLICATION.

YEO'S PATENT ENGINE PACKING,

Price 1s. 8d. per lb., any size.
Tarred & White Spun Yarn for Pipe Joints, at various prices.
Samples and testimonials free per post.
E. YEO, NEWTON ABBOT.

CATHELS'S Patent Gas-Washer is an excellent cleanser of gas from tar, ammonia, sulphur, and carbonic acid, reducing the cost of subsequent purification 30 to 50 per cent. Needs no motive power or attention beyond drawing off and recharging as required. Has no moving parts or complications to get out of order. Is of moderate cost, and is practically indestructible.

Application to be made to the MANUFACTURERS, the Horseley Company, Tipton, STAFFORDSHIRE.

PARIS EXHIBITION, 1878.

MM. SERVIER, MONNIER, ROUGET, Engineers, specially in connection with the industry of Gas Lighting, will undertake to represent any Manufacturers who may be Exhibiting Goods in Classes 27 and 53. References in France and England.

OFFICE: 18, RUE DE MAUBEUGE, PARIS.

BELGIAN CLAY RETORTS.

J. SUGG and CO., late ALBERT KELLER, GHENT.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Messrs. Sugg, of Ghent, beg to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by them. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

Communications addressed to J. SUGG & Co., GHENT, will receive immediate attention.

THOMAS LAMBERT & SONS

MANUFACTURE EVERY DESCRIPTION OF

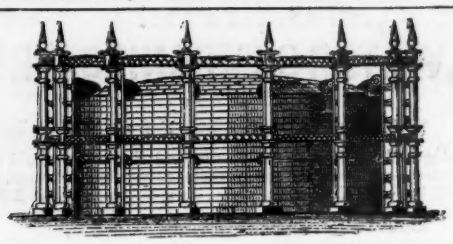
GAS AND WATER FITTINGS;

ALSO,

WROUGHT-IRON TUBES & FITTINGS.

SHORT STREET, LAMBETH, LONDON.

HOPE IRON WORKS,



STOCKTON ON TEES.

ASHMORE & WHILE,

GAS ENGINEERS & CONTRACTORS,

MANUFACTURERS OF GASHOLDERS,

GAS APPARATUS OF EVERY DESCRIPTION,

Including Improved

Retort-Lids, Boilers, Cast and Wrought Iron Tanks, Iron Roofing, Bridges, Girders,

And GENERAL IRONWORK.

N.B.—Estimates for all Gas Plant and Remodelling supplied on application.

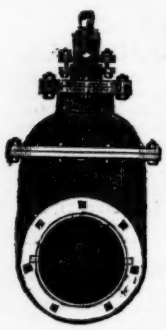
THE AMERICAN GAS-LIGHT JOURNAL.

A. M. CALLENDER & CO., Proprietors. G. WARREN DRESSER, Editor.

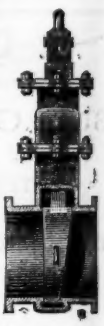
Issued Semi-Monthly at No. 42 Pine Street, New York City.

This Journal is especially devoted to Gas Engineering and Manufacture, and is the official organ of the AMERICAN GAS-LIGHT ASSOCIATION, and the NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

Subscriptions at $3.50 per annum, post paid, to Great Britain, may be made direct by forwarding Post Office Money Order or Draft to the above address. Rates of advertisement, $2.00 an inch. Special rates for larger spaces.



C. & W. WALKERS' DOUBLE-FACED GAS-VALVES.



These solidly constructed double-faced Gas-Valves have taken the place of the old system of the light, single-faced disc, which is too uncertain and unreliable in large bores.

They are guaranteed absolutely gas-tight. They are very massive and rigid, and by improved modes of manufacture they are produced at very little excess in cost over the old light, weak system, which is liable to spring and bend, and become leaky.

The Valve is a rigid wedge of solid cast iron, having two perfectly scraped surfaced facings fitting between the two on the body, which are also surfaced.

A spring in two short halves, and, therefore, not liable to break, is used only for scraping the front facing clean.

The front facing is vertical; the back facing forms the wedge.

At a slight additional expense both flanges are faced to bolt to main-pipes.

MIDLAND IRON-WORKS,

DONNINGTON, near NEWPORT, SHROPSHIRE; 8, FINSBURY CIRCUS, LONDON.

IMPROVED COMPENSATING GAS-METER.

HUNT'S PATENT.

This Meter supplies a want long felt, by putting an end to the loss sustained by Gas Companies through the overworking of their Meters.

These Meters can now be supplied in either TIN-PLATE or CAST-IRON CASES, and OLD METERS converted to this plan. GAS COMPANIES and CORPORATIONS will find it to THEIR ADVANTAGE to adopt these Meters.

EXTRACTS FROM REPORTS.

"I am able to report that the Meters have given in each test most satisfactory results."—*Mr. H. Sporne, City of London Meter Inspector.*

"I consider the arrangement is a great improvement upon the Meters in present general use."—*Mr. T. Jackson, Meter Inspector, Birmingham.*

"I would observe from the results of my testings that the Meters are a great improvement on the ordinary Wet Meters in general use."—*Mr. H. Airey, Meter Inspector to the Metropolitan Board of Works.*

COPIES OF REPORTS SENT ON APPLICATION.

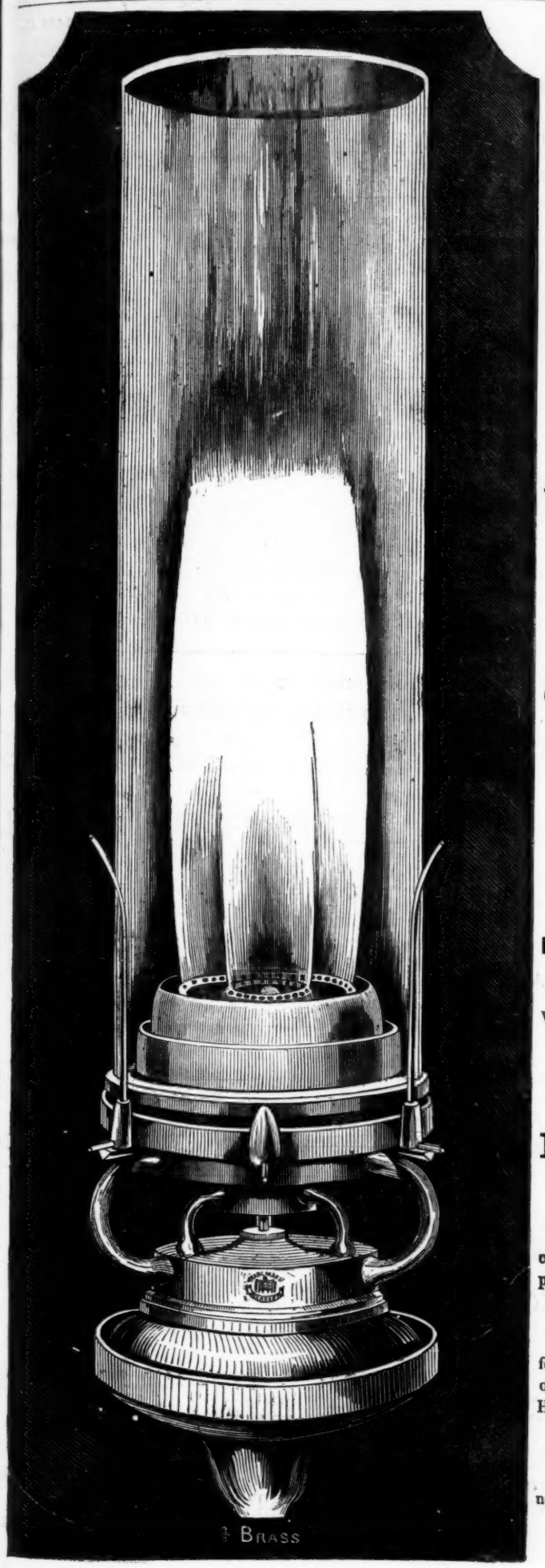
MANUFACTURED BY

JOHN BENT & SON,

WET AND DRY GAS-METER AND GAS APPARATUS MANUFACTURERS,

BELL BARN ROAD, BIRMINGHAM.

Established 1830.



PARIS, 1867.

LONDON, 1862.

WILLIAM SUGG,

GAS ENGINEER,

VINCENT WORKS, VINCENT ST.,

WESTMINSTER, S.W.

PATENT

"LONDON" ARGAND BURNER,

NEW SIZE, No. NN., DOUBLE FLAME,

With Self-Acting Governor.

LIGHT EQUAL TO 50 Parliamentary Sperm Candles of Six to the Pound.

Will burn any Quality of Gas from 12 to 50 candles, with

A VERY WHITE AND STEADY LIGHT.

Price 18s. each, with Chimney.

☞ **This Burner gives a greater amount of light per cubic foot of gas consumed than any other Burner yet produced.**

It can be used with Albatrine Shade, 20-in. diameter, for large Dining-Rooms or Halls; or with Large Silvered or Enamelled Reflector for Shops or Warehouses; or for Harbour and Signal Lights, Clock-Towers, &c.

The Sizes of the Patent "London" Argand Burner are now as follows:—

OLD SIZES: Nos. A, B, C, D, E, F, G, and H.
NEW SIZES: J, K, and NN.

HALLETT'S
PATENT ANTIMONY PAINT.

MADE ONLY BY

GEORGE HALLETT & CO.,
296, ROTHERHITHE, LONDON, S.E.

This Paint having been in general use over sixteen years (especially in some of the principal Gas-Works), and proved itself the best light-coloured Paint produced for resisting the influence of vitiated atmospheres, it is important that its qualities should be more widely known. Its advantages are that—

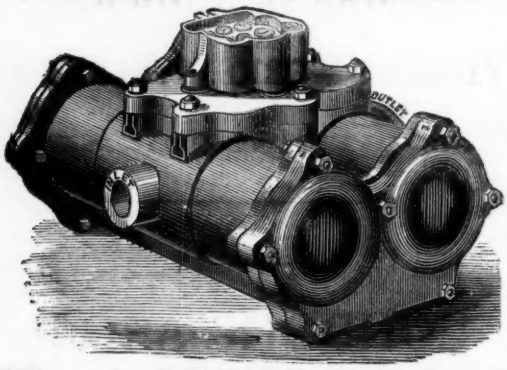
It does not require DRIERS like other Paints.

It does not poison the painter like white lead. No colic by its use.

It has greater durability in colour, as sulphurous gases do not blacken it as they do white lead.

It is of a light stone colour, and has a body equal to white lead, and as its specific gravity is so much less, it covers equally well one-third more surface, by which a great saving is effected; a similar economy arises from its use in steam and gas joints, for which purpose it is superior to white lead.

THE
UNION WATER-METER CO., LIMITED.



The above Company, having purchased the patent rights of the Union Water-Meter, are prepared to receive and execute orders for their Patent Positive Meters, which are simple and compact.

Upwards of 20,000 of these Meters are in successful operation in the principal cities of the United States, and have also been tested and approved by some of the leading Engineers in this country.

For Prospectuses, Prices, &c., apply to the

COMPANY'S OFFICES:

No. 4, NEW BROAD STREET, LONDON, E.C.

THE
STANDARD WASHER AND SCRUBBER.
[KIRKHAM, HULETT, AND CHANDLER'S PATENT.]

Some of the advantages claimed for this Apparatus are as follow:—

The Exposing of a large Amount of Effectually-wetted Surface (which is continually reproduced) to act upon the Gas.

Unerring Regularity in the Distribution of the Liquor.

Saving of Expense in Providing and Exchanging Scrubbing Material—none being required.

Economy of Space, thus enabling the Apparatus to be protected from the Weather.

Economy of First Cost and of Maintenance.

It works without Pressure.

It is particularly adapted for Gas-Works where Sulphate of Ammonia is manufactured.

Applications for Prices, &c., to be made to

Messrs. KIRKHAM & HERSEY, GAS ENGINEERS, 21, ABINGDON STREET, WESTMINSTER.

THE
IMPERIAL METER COMPANY,
LIMITED,

KING'S ROAD, LONDON, N.W.,

OFFICE: 115, VICTORIA STREET, WESTMINSTER, S.W.,

MANUFACTURERS OF

"WET" & "DRY" GAS-METERS IN IRON & TIN-PLATE CASES

STATION-METERS AND GOVERNORS, STREET-LAMP METERS, BOXES, AND REGULATORS FOR THE AVERAGE METER SYSTEM.

Attention is called to their Dry Meters in Wood Cases, as used by the principal London Gas Companies. These Meters are especially suitable for seaport towns and for export.

The Company repair or convert every description of Wet Gas-Meters to De Castro and Burton's Patent.

SAMUEL CUTLER & SONS,

CONTRACTORS FOR GAS AND WATER WORKS, GENERAL ENGINEERS,

IRONFOUNDERS, AND MANUFACTURERS

OF

GASHOLDERS, TANKS, PURIFIERS,

SCRUBBERS, VALVES, EXHAUSTERS, IRON ROOFS, BRIDGES, BOILERS,

AND

GENERAL CAST AND WROUGHT IRON WORKS.

S. C. & Sons undertake the entire Erection of New, or Remodelling of existing Gas-Works in any part of the World, including small Works for MANSIONS, FACTORIES, &c., or Works of the largest extent (are now constructing the largest Gasholder yet erected); also the Supplying and Laying of MAINS.

They make a speciality of supplying every requisite whatever for a Gas-Work, keeping in Stock what are most in request. WOOD SIEVES for Purifiers and Scrubbers, of a superior make.

SPECIAL CASTINGS to Drawing or Pattern at Shortest Notice.

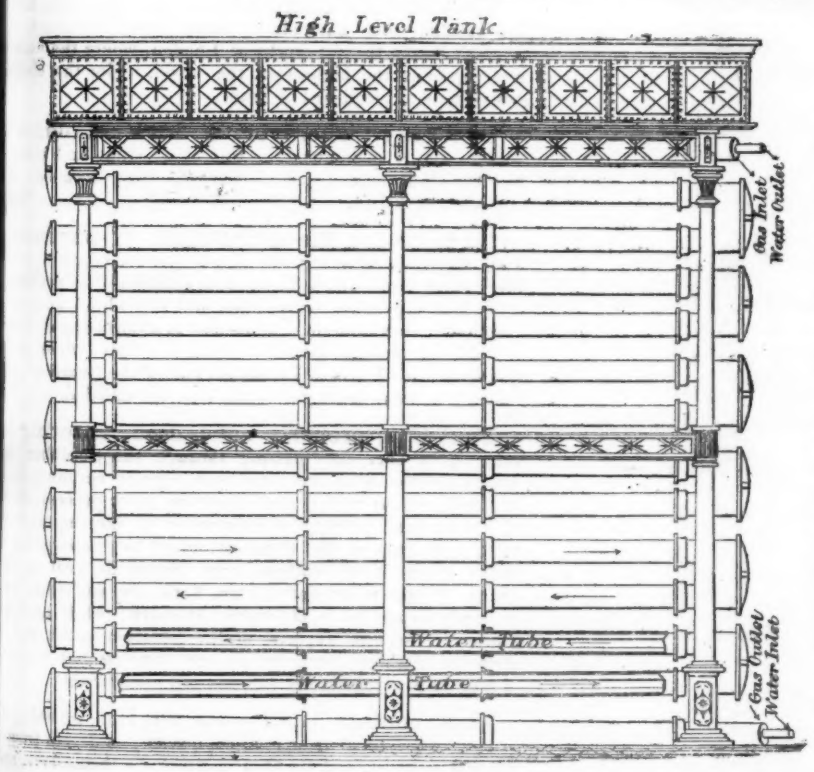
MANUFACTURERS OF

MORRIS & CUTLER'S PATENT CONDENSER

AND

CUTLER'S PATENT GAS-WASHER.

(For Illustration and Description, see "Journal" for April 16, page 583.)



Description of Morris & Cutler's Patent Condenser.

The Condenser may consist of pipes arranged in tiers as shown, or in any other form most convenient to the site available, each tier being connected with special connexions, and containing within same either one or more coils of smaller pipe through which water is passed, being supplied from any convenient source of supply, the water passing in an opposite direction to the gas, so that the coldest water is at the gas outlet. The power of the Condenser can be regulated precisely in proportion to the quantity of water allowed to pass through, which is not in any way contaminated, but simply heated by the hot gas, and advantage can be taken of its being at a high level to carry it to a high-level cistern, from whence it can be used for supply to boiler or any other purpose. (The Condenser itself may form the support for a high-level cistern as illustrated.) By an arrangement of valves the water may be shut off, and an air orifice opened, when air will pass through instead of water, or both air and water can be shut off. The power of the Condenser is, therefore, entirely under control.

The Condenser may be seen in operation at the Brentford Gas-Works.

For further Particulars, apply to

Mr. F. MORRIS, GAS-WORKS, BRENTFORD,

OR TO

S. CUTLER & SONS,

PROVIDENCE WORKS, MILLWALL (Near the Steamboat Pier), LONDON, E.

C. & W. WALKER,
8, FINSBURY CIRCUS,
LONDON, E.C.

MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

It is to be particularly noted that the important results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

Fifty million cubic feet of gas per 24 hours are purified from ammonia by these Patent Scrubbers in a winter's day in the gas-works of London, where the purity of gas supply is the highest in the world, under the chemical restrictions of the Board of Trade.

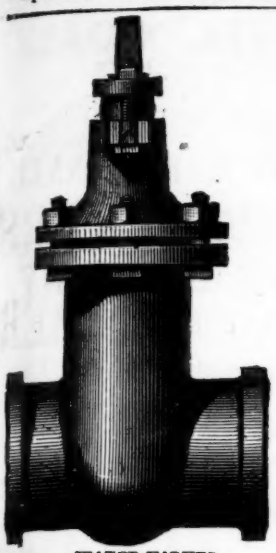
Generally, wherever a high standard of purification is maintained in the chief cities and towns of the British Provinces and of Europe, these Scrubbers have become established.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machine-room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

They contain their own engine power, requiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

Applications relating to dimensions and prices should be addressed to us, C. AND W. WALKER, 8, FINSBURY CIRCUS, LONDON, E.C., or to Mr. WILLIAM MANN, late Superintendent of the Chartered Gas-Works, BLACKFRIARS, LONDON; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.



WATER-VALVES.
All Sizes, Flange and Socket, kept in Stock, tested to 1000 feethead.

SIMPSON & COMPANY,

ENGINE-WORKS,

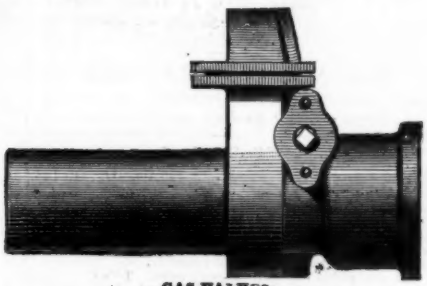
GROSVENOR ROAD, PIMLICO,

LONDON.

SCREW-COCKS, HYDRANTS,
SLUICES, PENSTOCKS,

And all other Machinery for

WORKS OF WATER SUPPLY, DRAINAGE AND IRRIGATION.



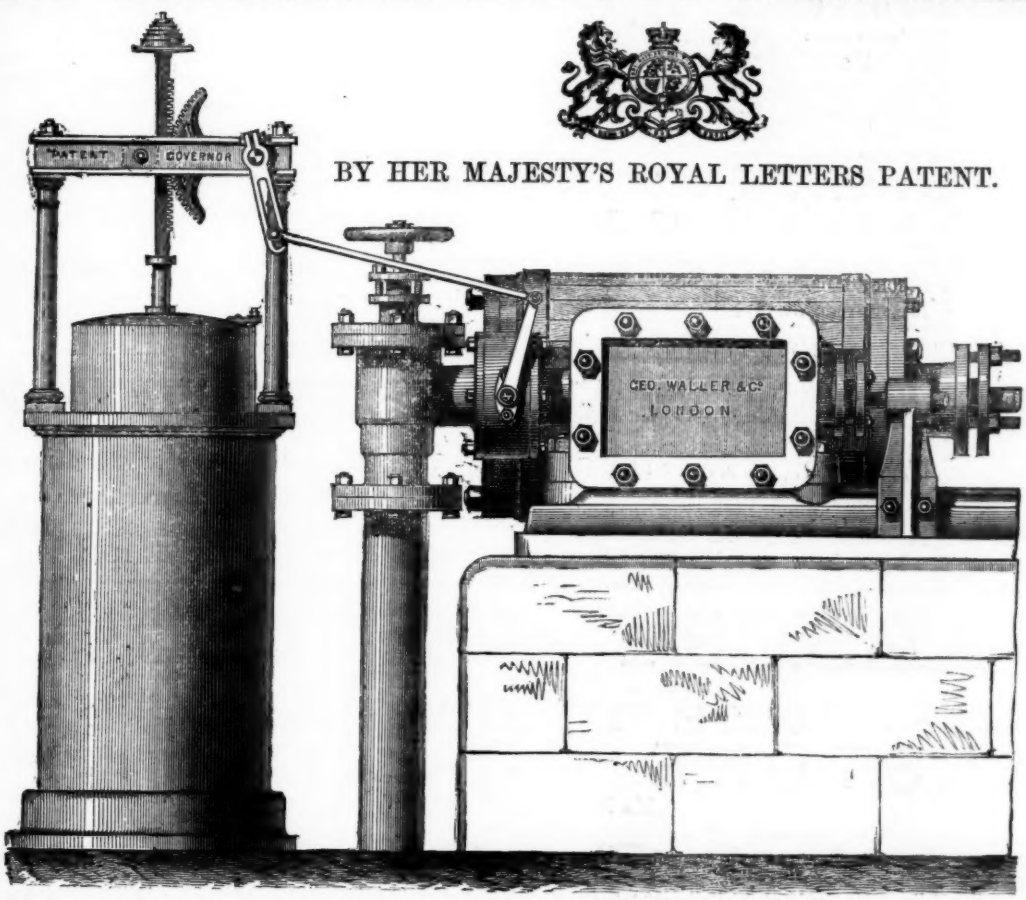
GAS-VALVES.
All Sizes, Flange and Socket, kept in Stock, tested to 100 feet head.

GEORGE WALLER & CO.,

GAS AND HYDRAULIC ENGINEERS.

PATENT COMPENSATING HYDRAULIC STEAM-GOVERNOR.

BY HER MAJESTY'S ROYAL LETTERS PATENT.



G. W. & Co. have designed this Patent Compensating Governor to work on an **entirely novel principle,** and to meet a want much felt in Gas-Works. The bell contains a **self-acting water-balance** in addition to the float. The clip arm on the quadrant pin can be **fixed at any angle,** so as to connect either above, below, or horizontally (as in the engraving), and with **only one rod.** This Governor will so regulate the speed of the Engine that a **steady gauge** is maintained at all times, even with **considerable variation** in the gas-main and in the boiler pressure, thus combining advantages **not attained by any other Governor.**

Phœnix Engineering Works, Holland Street, Southwark, S.E.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

173, ST. VINCENT STREET, GLASGOW.

SHOTT'S BOGHEAD.

LOTHIAN'S CANNEL

Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

MUIRKIRK, No. 1, CANNEL

Yields 12,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash.

OLD WEMYSS CANNEL

Yields 13,320 cubic feet of 32·5-candle gas per ton.

Prices and full Analyses on application.

GAS COAL.

POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12¼ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

SCOTCH CANNEL COALS.

The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

JAMES M'KELVIE,

CANNEL COAL MERCHANT,

HAYMARKET, EDINBURGH.

Established 1840.

HEBBURN MAIN GAS COALS.

T. Stone, Esq., of Weymouth, writes on Nov. 17, 1876: "I have used about 12,000 tons of this Coal, with, I think, the best possible results, although not always under the most favourable circumstances. My Coal account made up to Midsummer last showed a makeage of 10,594 cubic feet per ton of 14¼-candle gas, and not a hundredweight of Cannel used. This statement would, I know, be incredible to many men, and may provoke the remark, 'How much of it is paid for?' For the gratification of such, I have to say that, of the above quantity, 9866 cubic feet per ton of Coal carbonized were brought to charge and duly paid for, with the exception of about 6s. per cent. for bad debts. The coke is of excellent quality. The above facts I hold to be a greater recommendation to your Coal than any words of mine could be."

PRICES ON APPLICATION, EITHER F.O.B. OR BY RAIL IN TRUCK LOADS.

THE TYNE COAL COMPANY, LIMITED, OWNERS.
W. RICHARDSON, Fitter,
29, QUAYSIDE, NEWCASTLE-ON-TYNE.

LESMAHAGOW CANNEL COAL.

FERRAND DAVIES,

148, GRESHAM HOUSE, OLD BROAD STREET, LONDON, E.C.,

SOLE AGENT FOR

THOMAS BARR'S LESMAHAGOW MAIN CANNEL.

Quotation and Analysis forwarded on application.

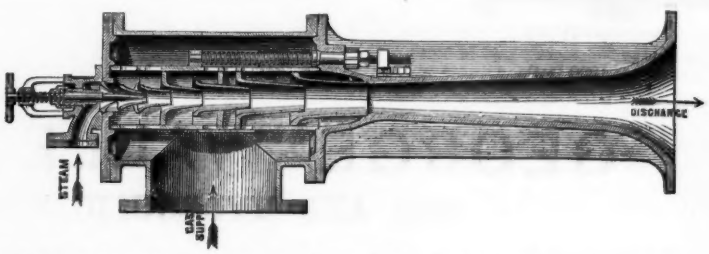
MIDLAND & YORKSHIRE COMPANY,

COAL OWNERS AND FACTORS,

Supply to any Railway Station the best descriptions of Gas Coal, Nuts, and Cannel.

PRICES ON APPLICATION.

HEAD OFFICE: 79, MARK LANE, LONDON.



KÖRTING'S STEAM-JET GAS-EXHAUSTER.

IMPROVED CLELAND'S PATENT.

UPWARDS OF 250 IN USE.

CLELAND'S PATENT CONDENSER AND STEAM SCRUBBER.

FOR PARTICULARS, APPLY TO

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OR TO

GERALD J. TUPP, 8, John Street, Adelphi, W.C., LONDON,

SOLE AGENT FOR ENGLAND AND WALES.

THE WIGAN COAL & IRON COMPANY,

LIMITED,

DISTRICT OFFICE: 97, NEW STREET, BIRMINGHAM; AGENT: W. M'GOWAN;

Supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, &c.

N.B.—The Wigan Coal and Iron Company, Limited, are exclusive owners of the well-known HAIGH HALL AND KIRKLESS HALL GAS COAL COLLIERIES.

ALBERT GAS COAL.

THE DERBYSHIRE

SILKSTONE COAL COMPANY,

LIMITED,

CAN OFFER A

GAS COAL

Of superior quality, delivered in trucks at any Railway Station in England, or shipped on board at Hull, Grimsby Docks, or Barrow-in-Furness.

Purified gas per ton of coal in cubic feet (average)	10,262
Illuminating power in candles	15·86
Weight of coke in lbs. per ton of coal	1,502

ANALYSIS AND PRICES ON APPLICATION TO

Mr. EDMUND TAYLOR, Secretary,

ALBERT COLLIERY, NEWBOLD, NEAR CHESTERFIELD.

THE SILKSTONE & DODWORTH COAL & IRON COMPANY, LIMITED,

DODWORTH, BARNSLEY.

BENJAMIN WHITWORTH, Esq., M.P. . . . . Chairman.
Mr. RICHARD HARTLEY . . . . . Managing Director.

REAL OLD SILKSTONE GAS COAL.

JAMES PATERSON, Esq., Gas Engineer, of the Warrington Gas Company, reported, Aug. 10, 1875:—

"This Coal possesses remarkable qualities as a gas and coking coal, and appears SECOND TO NONE IN THE KINGDOM. It contains the large quantity of 699 lbs. of illuminating matter, and 1498 lbs. of coke to the ton, and produces **12,240** cubic feet of 16·66 candle gas."

The above Company are raising nearly a thousand tons of the Real Old Silkstone Gas Coal per working day.

PRICES QUOTED TO ANY RAILWAY STATION, OR F.O.B. HULL, GRIMSBY, GOOLE, KEADBY, LIVERPOOL, AND FLEETWOOD.

HYDRATED PURIFYING MATERIAL.

Samples on application.

MESSRS. SPENCE BROS., LIMITED,

Will be glad to supply the above on the most favourable terms,

And to treat, by Purchase or Exchange, for Spent Oxide.

PRICES ON APPLICATION.

ALSO PATENT DRY COPPERAS FOR EXTRACTING AMMONIA.

VICTORIA CHEMICAL WORKS, BRADFORD, NEAR MANCHESTER.

Established

1795.

JOSEPH CLIFF & SONS,

THE ORIGINAL

WORTLEY FIRE-BRICK WORKS,

NEAR LEEDS,

London Wharf: No. 4, inside Great Northern Goods Station, King's Cross, N.;

LIVERPOOL: Back Leeds Street.

SPECIAL NOTICE.—Our Patent Machine-made Retorts have now been in *actual work* nearly 1000 days, and are yet in good order. References on application.

July 2, 1877.

NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS AND COLLIERIES,

NEAR SHEFFIELD,

CELEBRATED SILKSTONE GAS COALS.

The various descriptions of Gas Coal produced from the above Collieries possess an unequalled reputation, combining in a large degree the constituents essential for the production of the best quality of Coke and Gas of a high illuminating power.

A recent extensive development of the Collieries enables us to offer increased supplies.

JAS. PATERSON, Esq., of Warrington, after testing various qualities of our Coal, has sent the following testimony of their merits:—

"*Warrington Gaslight and Coke Company,*
Offices, Mersey Street, Warrington, April 23, 1877.

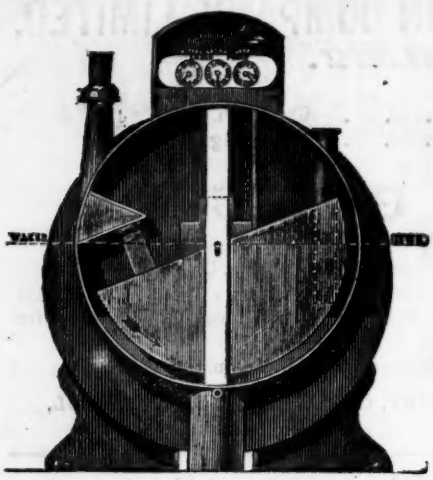
"MESSRS. NEWTON, CHAMBERS, AND CO.,

"GENTLEMEN,—After carefully testing the various samples of Gas Coals sent from your Collieries for analysis, I have pleasure in reporting them as belonging to the highest class of Gas and Coking Coals.

"The average of Nine samples gives a yield of **12,500** cubic feet of **15½**-Candle Gas, being equivalent to **664** lbs. of sperm per ton, and **1420** lbs. of fixed carbon of a very superior quality. All the samples bear a close relation to each other in value.

"Yours truly, "JAMES PATERSON."

Full particulars will be sent on application to us—address as above.



THE
UNVARYING WATER-LINE GAS-METER.
(SANDERS AND DONOVAN'S PATENT.)

"Unquestionably the best Water Gas-Meter now in use."—Thos. G. Barlow, C.E.

Over 120,000 in action.

MANUFACTURERS:
THE GAS-METER COMPANY, LIMITED,
KINGSLAND ROAD, LONDON;
WITH
Branch Manufactories at DUBLIN and OLDHAM.

ALEXANDER WRIGHT & CO.,
MANUFACTURERS OF
"WET" AND "DRY" GAS-METERS,
STATION-METERS, AND GOVERNORS.
METERS, BOXES, REGULATORS, AND ALL REQUISITES FOR PUBLIC LIGHTING.
TESTING APPARATUS for all purposes relating to Gas, &c.
MR. VERNON HARCOURT'S COLOUR TESTS,
Descriptive particulars, per post, 2d.
55, 55a, & 56, MILLBANK STREET, WESTMINSTER,
LONDON, S.W.

R. LAIDLAW AND SON,
EDINBURGH AND GLASGOW.
Manufacturers of
CONSUMERS IMPROVED WET GAS-METERS,
THE UNVARYING WATER-LINE GAS-METERS,
IMPROVED DRY GAS-METERS, in Cast-Iron or Tin-Plate Cases;
STATION-METERS, ALL SIZES, up to 15 feet Square, with PLANED JOINTS;
Experimental Meters, Photometers, Pressure-Gauges,
Governors, Test Holders, &c., &c.
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JOHN ABBOT & CO., LIMITED,
MANUFACTURERS OF
IMPROVED
HYDRAULIC CRANES & HOISTS,
Effecting an IMMENSE SAVING in the cost of discharging Coals from Vessels, Barges, &c.
HYDRAULIC RAMS FOR LIFTING AND LOWERING PURIFIER COVERS
GAS PLANT GENERALLY, PIPES, ROOFING, TANKS, &c.,
PARK WORKS, GATESHEAD.
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GLASGOW OFFICES:
54, ST. ENOCH'S SQUARE.

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